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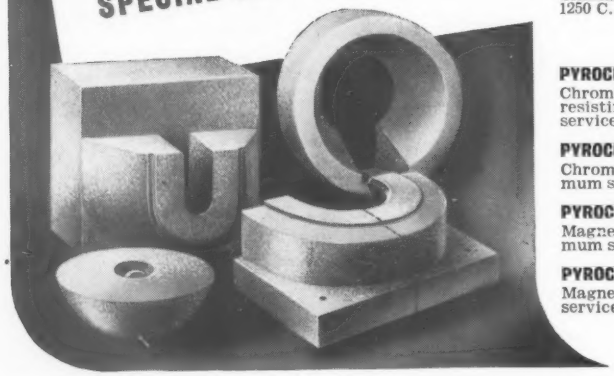

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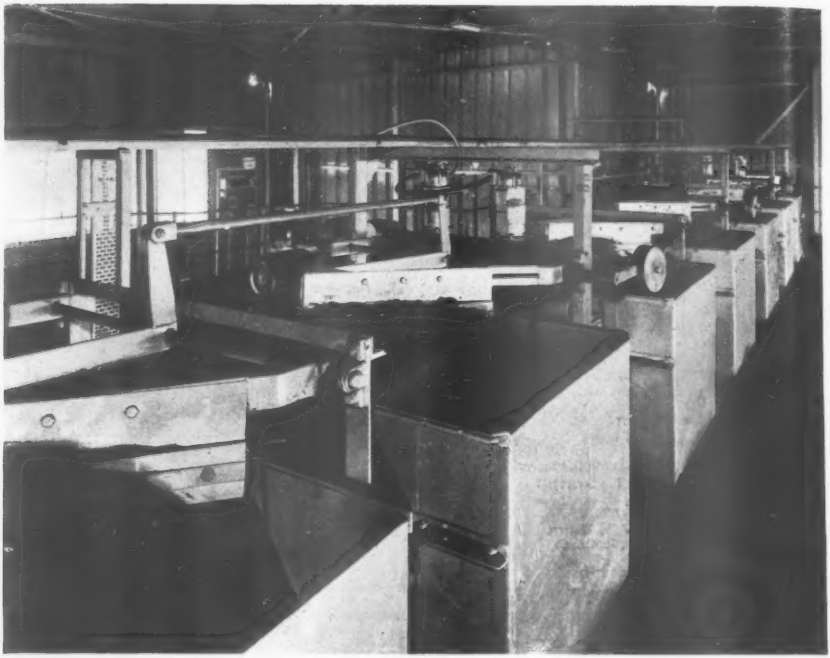

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Modern Foundry Plant for BATH MAKING

Photograph shows:

Belt conveyor with automatic plough arrangement for ploughing off reconditioned moulding sand into large storage hoppers.

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FOUNDRY
TRADE JOURNAL

Vol. 105 NOVEMBER 20, 1958 No. 2197

Industrial Health Report

The new Chief Inspector of Factories, Mr. T. W. McCullough, this year decided to divide the Factory Report into two sections—the first, concerned with accidents, was published several months earlier than usual, and the second, relating to industrial health,* has just been released. This second report, which also covers the year 1957, shows that in the whole of the foundry industry, there were 67 death certificates issued attributing pneumoconiosis as the cause. Detailed figures show that, whilst in steel foundries the deaths in 1956 (32), were lower, in 1957 (23), those in iron foundries rose from 23 to 28. Another germane observation is that while, during the last five years, there were nine deaths recorded amongst the non-ferrous foundries in England and Wales, there was none in Scotland. The figures are complicated by the existence of a heading "others and mixed foundries."

In this Report, a special chapter (III) is given over to dermatitis, because the Chief Inspector rightly considers this to be important. From June 7, 1954, to June 4, 1955, there were 17,400 spells of certified incapacity for employment for males and 4,900 for females owing to this cause; the estimated average duration of a spell of incapacity being 41 days for males and 48 days for females, with a total of 930,000 days lost in the period under review. In the traditional processes of the manufacture of castings, there was little fear of dermatitis, but there would appear to be risk with some of the more recent methods, both of moulding and patternmaking. The Report gives (in five paragraphs) advice as to how the incidence of this ailment can be prevented. The second paragraph, "selection of personnel," which takes up over six lines, could from the practical point of view be summed up by stating "beware of blondes and redheads," as nature has made this class more susceptible to dermatitis. The recommendations set out are sensible and should be meticulously followed.

An important factor affecting industrial health is carbon-monoxide poisoning and in this case, it is encouraging to learn that at 76 cases reported, the figure is the lowest for at least 20 years. The risk to foundry employees from this source is minimal and can usually be assigned to an accidental occurrence of the gas either at the cupola or drying stoves. The danger from coke braziers (never, to our mind, a serious one) has been removed by Regulation. If foundrymen still have occasion to employ braziers, then they would be well advised to ensure that they are lighted in the yard and are brightly burning before being brought into the shops. As an additional precaution, it is well to take them into the yard again when refuelling. Another industrial disease, which has now been virtually eliminated from the vitreous-enamelling departments of iron foundries is lead poisoning, as, since 1953, only two cases (neither fatal) have been notified. In a non-ferrous foundry, however, there was the case of a man whose job it was to polish gunmetal carrying a 5 per cent. lead content and (sometimes) copper tube banded with a solder carrying 50 per cent. lead. His working place was badly ventilated and he contracted bilateral radial nerve palsy—a bad phase of lead poisoning. The Report should be read with care by all those responsible for the conduct of industrial enterprises, as therein they will find much help in the minimizing of industrial diseases.

* Annual Report of the Chief Inspector of Factories on Industrial Health for the year 1957. Published by H.M. Stationery Office, York House, Kingsway, London, W.C.2; price 3s. net.

Public Works Exhibition

The JOURNAL'S representative paid a short visit last week to the Public Works and Municipal Services Congress and Exhibition, which closed last week-end. This was a really comprehensive show with over 600 stands displaying innumerable tractors, cranes, pumps, and a wide range of other equipment. (Short paragraphs describing some of the stands appeared in the October 30 issue of the JOURNAL, page 557). The now familiar modern sales-boosting devices were in use, *e.g.*, closed-circuit television (showing the onlookers how they appeared when they themselves were looking on), films, working models, attractive receptionists, competitions, etc.

Amongst the tractors on view, one of the most interesting was the D8 crawler model made by Caterpillar Tractor Company, Limited, although the prize, if any, for sheer immensity must almost certainly go to Michigan (Great Britain) Limited. Their tractor-dozer, model 380, was enormous, having tyres like little barrage balloons. Many truck/mixers were also on show, those manufactured by Ransomes and Rapier, Limited, being representative of the better types.

Handling Equipment

A large range of handling equipment was displayed, amongst which one item in particular impressed the reviewer. This was a straddle-carrier designed to carry materials slung beneath the control cabin, which stands several feet clear of the ground on four heavy-duty tyres. This machine can efficiently transport a variety of awkwardly-shaped loads, such as cast-iron pipes, without danger of them slipping or rolling. Another piece of equipment which caught the eye was a hydraulic platform of exceptional manœuvrability, which might be a very useful addition to the maintenance department of a large foundry. This platform, produced by Simon Engineering (Midlands), Limited, has a maximum working height of 30 ft. and a maximum load of 500 lb.

Castings, both large and small, were well to the fore at the Exhibition, mainly, of course, as components of machinery of all kinds, *e.g.*, crushers, pumps, trucks, tractors, etc. Many big pump-valves were displayed, notably by Guest & Chrimes, Limited, while the Victaulic Company, Limited, exhibited a wide range of small joints and fittings. Outstanding amongst the miniature models were those demonstrating the Kue-Ken crushers, made by Armstrong Whitworth (Metal Industries), Limited.

Naturally, it was not possible to give individual attention to each of the 669 stands, and the items mentioned must be regarded as merely a cross-section of the very wide range of equipment on show. It was clear, however, that this year the trend towards increasing mechanization of municipal engineering, from manhole covers to giant excavators, had continued. The foundry industry was well represented, and it appeared that increasing use was being made of high-quality castings for the vital parts of many machines. Furthermore, castings seemed at least to be holding their own in competition with weldments in the provision of lower-stressed frames and constructional accessories.

NOVEMBER 28

Incorporated Plant Engineers

Birmingham branch: "Statutory Regulations of Steam and Pressure Vessels" (film and talk), 7.30 p.m., at Imperial Hotel, Temple Street.

Institute of British Foundrymen

Falkirk section: "Foundry Sands," by W. B. Parkes and R. G. Godding, 7.30 p.m., at the Temperance Café, Lint Riggs.

Forthcoming Events

NOVEMBER 24

Association of Bronze & Brass Founders

Lancashire and Cheshire area: Discussion of matters of current interest commencing 4.30 p.m., followed by an open meeting at 6.30 p.m., when the Association's publication "Costing a Casting" will be discussed.

NOVEMBER 25

Institute of British Foundrymen

Slough section: "£. s. d. in the Foundry," by G. B. Judd, 7.30 p.m., in the Lecture Theatre, High Duty Alloys, Limited.

Institution of Production Engineers

Loughborough College student section: "Modern Foundry for the Manufacture of Small Steel Castings by New Moulding Techniques," by J. H. Osborn, 7.30 p.m., in Room A.1, Loughborough College, Schofield Building, Ashby Road.

Incorporated Plant Engineers

South Wales branch: "Corrosion," by D. W. Marshall, 7.30 p.m., at the South Wales Engineers' Institute, Park Place, Cardiff.

Institution of Chemical Engineers

London branch: "Extended Equation for the Performance of Machines Mixing Two Powders," by H. E. Rose, 5.30 p.m., at the Geological Society, Burlington House, W.1.

North-western branch: "Pollution Law and the Chemical Engineer," by R. R. Ferner, 7 p.m., at the Birkenhead Technical College.

NOVEMBER 26

Institute of British Foundrymen

Birmingham branch: "Practical Aspects of the Control of Quality of Aluminium-alloy Sand Castings," by D. B. McNair, 7.15 p.m., at the James Watt Memorial Institute, Great Charles Street.

Southampton section: Film evening: "Design and Pattern-making," "Aluminium Matchplates," "New Ideas at Work in the Foundry," "Automatic Moulding," and "After the Shake-out," 7.30 p.m., at the Technical College, St. Mary's Street.

NOVEMBER 27

Incorporated Plant Engineers

Sheffield & district branch: "Fire Prevention," by an officer of the Sheffield Fire Brigade, 7.30 p.m., at the Grand Hotel, Sheffield.

Institute of Metals

Birmingham local section: "Corrosion and the Microstructure," by C. Edeleanu, 6.30 p.m., at the Engineering Centre, Stephenson Place.

(*Continued at foot of previous column*)

Introducing the Author

Mr. J. S. TURNBULL, whose recent paper to the Institution of Mechanical Engineers appears on the facing page, is technical and executive director of Lake & Elliot, Limited, engineers and steelfounders, Braintree, Essex. He was born in Essex in 1915 and attended Felsted School from 1928 to 1933. He was then at Faraday House engineering college, London, from 1933 to 1937, with one year's apprenticeship at Ransomes & Rapier, Limited, Ipswich, and two years' apprenticeship at Metropolitan-Vickers Electrical Company, Limited, Manchester.

In 1936, he received an honours diploma at Faraday House (equivalent to B.SC.) and became president of the Apprentices' Association Council in 1937.

Mr. Turnbull was appointed engineer-in-charge of the lost-wax precision-casting foundry at Metropolitan-Vickers Electrical Company, Limited, in 1945, and there developed the Investment X process. In 1954 he was promoted to works development engineer for Metropolitan-Vickers and remained there until his appointment this year with Lake & Elliot.

Precision Sand Casting*

(Slightly abridged)

By J. S. Turnbull, A.M.I.Mech.E.

This paper comments on the great value of liquid forming as a method of shape production, which will reduce or eliminate the man-machine-hours used in shaping solid metal. The difficulties associated with the casting of steel are very considerable in comparison with cast-iron; out of 23,000,000 tons of steel produced annually, only 300,000 tons are castings. Investment founders have learnt much about the technology of steelfounding; however, these processes are restricted in application. In order to obtain steel and other castings which will reduce or eliminate man/machine/hours, it will be necessary to combine the versatility of the sand foundry with the technology of the investment foundry. The Alphax process of precision sand-casting is described. In conclusion it is pointed out that new foundry processes will be used only if designers have confidence in the metallurgical soundness of the castings, and are aware of the advantages which castings offer. Apart from new moulding techniques, attention is drawn to the fact that patternmaking requires better materials and machinery, and castings require purer gas-free liquid metal.

In the manufacture of metal components used in engineering, increased productivity can be obtained by three main approaches: (1) Capital investment. In the narrowest sense a new machine tool will produce more for the same manual effort. In the widest sense a series of machine-tools strung together will automate manufacture; (2) higher incentives to obtain greater manual effort, and (3) process development by re-examination of all possible methods of manufacture.

In assessing (3), metal components can be formed or shaped in three different states: (*a*) Solid state, machining from the solid; (*b*) plastic state, forging, extrusion, hot brass pressing, and (*c*) liquid state, casting techniques. Since the mechanical effort required is far less in the case of liquid forming than for plastic or solid forming, it is quite obvious that far greater effort should be concentrated on the application of foundry technique, rather than be satisfied with the present general trend of hammering red-hot metal into shape or "hogging" shapes out of solid metal. In specific industrial products, it is often true that for over a ton of apparatus completed, as much as ½ ton of waste product is produced in the form of swarf, bar ends, etc.

This does not mean that the casting methods should supplant all other methods of forming, obviously there will always be cases where forging, machining, press work, extrusion, powder metallurgy, etc., will be the preferred method; nonetheless there are in industry to-day countless thousands of cases where components are machined from forged and extruded bar, when they could have been made as castings requiring considerably less machining. In an age when machining costs are high and skilled labour is scarce, it is of the utmost importance that methods of liquid forming should be used effectively, with a view to reducing or eliminating man-machine-hours.

* Paper presented at the 1958 conference on Technology of Engineering Manufacture organized by the Institution of Mechanical Engineers, and reprinted by courtesy of the Institution.

CASTING PROCESSES

In reviewing the present state of the foundry art relative to the ultimate requirements as set out in this paper, there is a clear majority use of sand-founding operating in a weight range of 185 tons down to a few pounds in weight.

Sand casting as the main method of casting production has the supreme advantage of offering flexibility in both long and short production runs, based essentially on simplicity of operation, that is, a wooden pattern, a sand mould, and the subsequent casting. The best example of material utilization and conservation of machine-tool capacity lies perhaps in the long-established partnership between the cast-iron foundry and the machine shop; here the low volumetric contraction of cast iron combines with excellent surface finish and delineation. It should not be forgotten, however, that as the casting decreases in size the surface finish and delineation grow steadily worse in comparison with a component machined from solid.

The exemplary behaviour of molten iron poured into sand moulds is certainly the exception rather than the rule, in comparison with other casting alloys, and it is generally true that the lower the tensile strength the better the castability. Considerable effort has been made to develop materials which combine the excellent castability of iron with the high-tensile properties characteristic of steel and its alloys; although malleable iron and s.-g. (or nodular) cast-iron (Bailey 1954) possess the requisite tensile strength, neither will cast as easily as cast-iron and, although their castability is generally better than that of steel, it does not appear likely that designers will use them as substitutes for steel on this account, but rather will reserve their use for applications more in keeping with their overall mechanical properties.

In examining the production of steel in the United Kingdom, it is highly significant that of a total tonnage of 23,000,000 tons produced annually, only 300,000 tons are castings. The fact that this figure is so low is almost certainly due to the

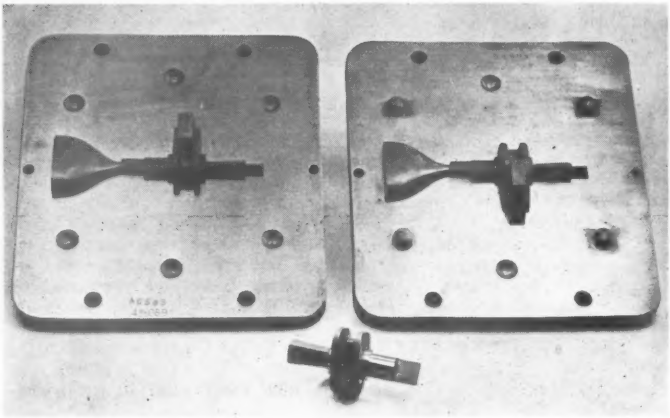


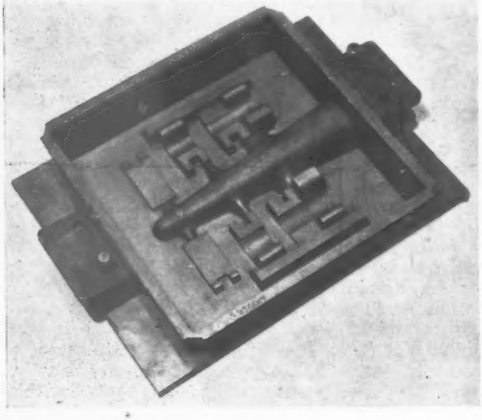
FIG. 1.—*Wooden patterns mounted on steel plates.*

difficulties associated with the casting of steel which can be summarized as: (1) High pouring temperatures, 1,600 deg. C.; (2) high volumetric contraction, 11 per cent., and (3) low strength and ductility of cast-steel at temperatures around 1,480 deg. C. Any process which is technically good enough to produce metallurgically-sound castings in steel and its alloys will also cast the great majority of ferrous and non-ferrous alloys, and it is highly significant that an ever-increasing number of metallurgically-sound steel castings are being absorbed into industry from the many precision-casting processes which have taken root in the last 15 years.

Precision-casting Processes

The author is well aware of the pitfalls which attend the selection of any one of the processes of precision casting. In too many cases a process has entered the arena with all the virtues of widespread application, but has not in fact justified the highest claims of its promoters, technically or economically. Principally, it is the author's contention that too many difficulties arise from lack of simplicity in operation and general misconceptions as to the capabilities and limitations of any particular process. It is important to realize that in any casting process, it is often impossible to predict the size of a finished casting, since this depends on: (*a*) Metal temperature; (*b*) restrictions to the free contraction of the casting, and (*c*) the fact that large-volume castings contract more than small-volume castings of the same length. In sand casting where modifications to wooden pattern equipment can be made relatively simply, this is not so serious, whereas in die casting, for example, it is not unknown for there to be as many as 17 separate modifications to the metal die before the casting emerges correct to drawing tolerances. For this reason, and this reason alone, any process which uses complex tooling such as die boxes, wax-injection dies, very accurate metal patternplates, etc., is best fitted for long production runs where these costs can be absorbed.

FIG. 2.—*Metal pattern-equipment for "flat-back" moulding, with locators.*



Precision casting processes can be segregated into four main categories: (1) Permanent-mould processes such as gravity-die-casting, pressure-die-casting and the Eaton-Erb process, where moulds are machined from solid metal; (2) semi-permanent mould processes which use high-grade refractory moulds for repetition casting cycles; (3) expendable-mould processes such as the Cronin (Bailey 1956) and Dietert (Dietert 1954) processes, which use sand with an organic binder, and (4) expendable-mould processes such as Shaw Process (Dunlop 1953), Lost-wax Process (Turnbull 1950), including Investment "X" (Turnbull 1955), and Glascast (Grant), together with the Mercast Process (Kramer 1955), all of which can be conveniently classified under the title of Investment Casting, using fired moulds with inorganic binders. In reviewing the above, within the context of this paper, it will be seen that the majority have a relatively limited sphere of application in comparison with sand casting.

Permanent Moulds

Permanent mould techniques in general, offer castings with the highest delineation, surface-finish, and accuracy, particularly in the case of pressure-die-castings, though these advantages are somewhat off-set metallurgically by the gas inclusions often found below the cast surface, which are the direct result of forcing metal into an impermeable mould. Permanent-mould casting is mainly restricted in its application to zinc-base alloys and aluminium,

though brass is sometimes used. The Eaton-Erb process makes use of grey-iron moulds with a surface layer of a refractory material for the manufacture of cast-iron components. Permanent-mould processes are restricted to long production runs due to the very high cost of the dies, which are machined from solid metal.

Semi-permanent Moulds

The use of semi-permanent moulds has application only in those cases where the cast shape will contract away from the mould walls, and is used mainly for non-ferrous alloys. Mention should be made, however, of the carbon-mould process, devised for the casting of steel railway wheels.

Expendable Moulds

The use of expendable-mould processes using organic binders has a much wider application. The Cronin process uses a thin shell mould of high strength and permeability. Since the moulds are reactive with molten metal the process is restricted to relatively thin-wall castings in most ferrous and non-ferrous alloys, including steel. The accuracy claimed is of the order of ± 0.005 in., and the castings are considerably better in delineation, surface-finish, and accuracy than those normally obtainable by conventional sand-moulding. The Dietert process uses an oil-bound, core-blown facing layer of refractory, supported by a metal carrier-plate, which is contoured around the pattern surface to leave a small space. Both processes use expensive tooling and are restricted on this account to long production runs.

Shaw Process

Perhaps the greatest single advance in casting technique over the last 15 years is the ability to make small castings in steel, and other high-melting-point alloys, which require little or no machining, and which give a high degree of metallurgical soundness. This is achieved by investment casting and the Shaw process. The Shaw process is equally as versatile as normal sand-founding, in that it uses patterns in wood or metal, and piece moulds with conventional cores. The tool costs are therefore very low, and this is further substantiated by the use of plaster-of-Paris coreboxes, which are considerably cheaper than metal coreboxes, and just as effective. The Shaw mould is formed by pouring a quick-setting slurry around the half-pattern, stripping the mould when it reaches a rubbery consistency, and firing it immediately. The mould consists of high-grade refractory, bonded by silica formed by the hydrolysis of ethyl silicate. The mould is fired to temperatures between 750 and 1,000 deg. C.

Investment-casting Process

The investment-casting process is more complex, since it involves a master die-box (similar to a die-casting), from which is manufactured a series of wax or mercury patterns. The patterns are then invested by a solid or shell refractory mould, bonded by ethyl silicate, phosphates or equivalent

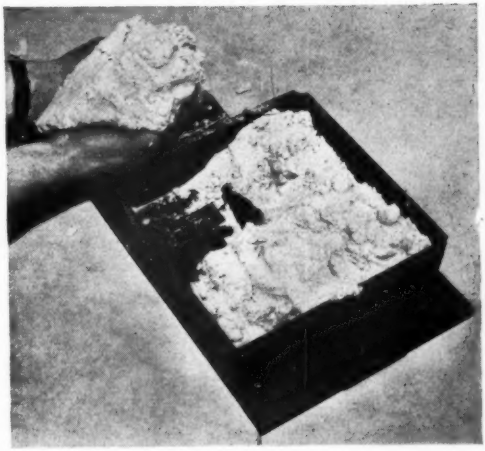


FIG. 3.—*Moulding box being hand-filled with plastic sand.*

materials. After removal of the pattern materials, by heat or solution treatment, the moulds are fired to 1,000 deg. C. In both the Shaw and investment-casting processes the mould is cast at 1,000 deg. C. or any other desirable temperature below this, to suit application.

FIG. 4.—*Sand being hydraulically pressed on to a patternplate.*

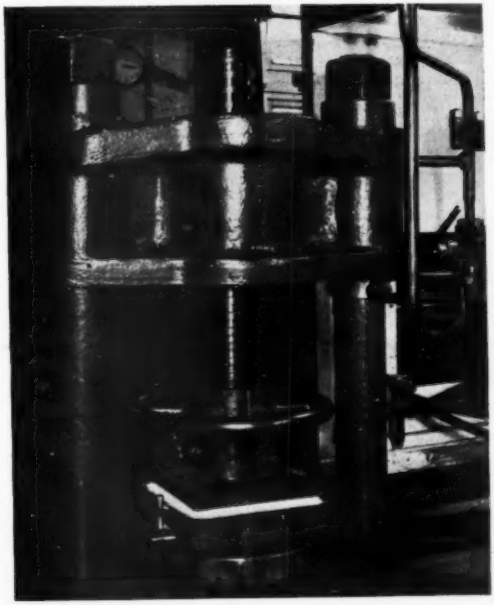


FIG. 5.—*Stripping the mould for the patternplate.*

Due to the high costs of the material used in the Shaw process, its application has been restricted to the manufacture of prototype castings and short production runs, where the costs of manufacture by alternative methods are prohibitive. Although the material costs of the investment process are considerably less, the high cost of tooling combined with the complexity of the process have restricted it to relatively long production runs in those applications mainly associated with complex shapes, where alternative methods of manufacture are economically prohibitive, and to those cases where the alloys are unmachinable.

Impact of Investment Casting and Shaw Process on Sand Founding

It must be appreciated that all investment-casting foundries, during their early stages of development, had to take on the rôle of research institutions to fathom the difficulties associated with the casting of steel, and other high-melting-point alloys, and that out of the knowledge thus gained has grown a technology which must surely play an important part in the improvement of sand founding. It is, therefore, disappointing to record that the impact of investment casting on the sand foundry has been extremely small, and in the author's opinion this is due largely to the fact that sand foundries are too busy producing castings for which there is considerable demand, and tend to turn their development skill to solving the immediate problems related to their present technique, rather than take a wider viewpoint, have a good look at the facts, and make a new start with better materials and technology, to extend foundry technique in the direction so urgently required.

It is of course equally true that investment foundries are limited in contributing to these requirements. The costs of Investment and Shaw castings are some ten times the cost of sand castings. For solid-mould processes (excluding Shaw) there is a weight limitation of approximately 15 lb., and a size limitation of approximately 7 in., and for integral shell moulds (Mercast and Investment "X") a weight limitation of 2 cwt. and a size limitation of 24 in. (the limitation of the Glascast process is unknown). Using the Shaw process, castings have been made weighing up to 10 cwt.

BRIDGING THE GAP

In order to bridge the gap between sand casting and investment or Shaw casting, it will be essential to incorporate the best features of each in order to obtain solid castings associated with the best possible economy of process operation. This will be commented on under the subheadings of (1) Liquid Metal, and (2) Moulds.

Liquid Metal

With regard to liquid metal the facilities available in the sand foundry would be infinitely preferable to those of the investment foundry. It has never been practicable to produce mild-steel castings in an investment foundry, owing to the nature of the melting facilities. In an investment foundry the best that can be done is to remelt bar ends, either in small indirect-arc furnaces or in high-frequency induction furnaces, and it is usual to add ferro-silicon or aluminium to "kill" the steel. The result is often disastrous due to dissolved hydrogen coming out of solution during solidification. The only alternative which is likely to be successful is to subject the melt to vacuum treatment to extract the harmful gas, but this is scarcely likely to be economic on small-scale production of mild-steel castings. The investment foun-

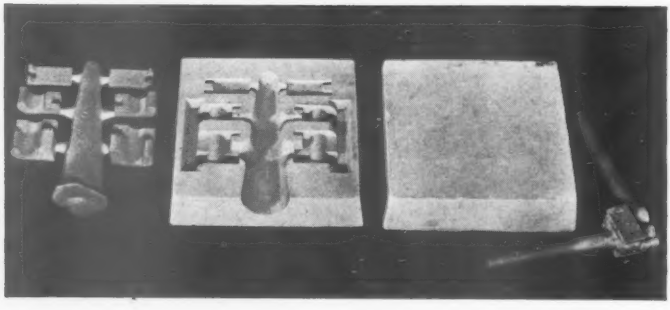


FIG. 6.—*Complete mould assembly with the casting, and (right) the finished tube clamp.*

dry is therefore limited to remelting techniques and is forced to use alloys as expensive substitutes for mild steel. Among the alloys successfully remelted for use in investment foundries are stainless-steels, austenitic and martensitic, nickel and cobalt-base alloys, and some of the high-carbon steels. With low-alloy steels castability becomes more and more difficult as the carbon and alloy content decreases. It is quite impossible to use pure iron. The melting of small quantities of alloys is one of the highest cost factors in the operation of the investment foundry and, in the author's firm, it represents approximately one third of the total cost.

The situation in the steel foundry is quite different, since it is usual to make a low-alloy steel in direct-arc furnaces, ranging from two tons upward. The quality and general cleanliness of the steel produced, together with the absence of dissolved gases, would appear to make this form of liquid-steel production highly suitable for application to precision-casting processes. It is obvious from this argument that the precision foundry of the future should be built into the existing steel foundry or, alternatively, into any other organization where liquid steel is available in bulk.

Moulds

To obtain the best results from casting processes, it is essential to use mould materials which are resistant to thermal shock, are non-reactive and can, when required, be cast hot. Although this specification coincides with the specification required in investment casting, it is not conversely true that only the present investment foundry materials can be used, as will be indicated in the Alphax process which is described below; it will however be desirable to depart from silica sand with its poor expansion characteristics and use zircon or any other suitable material. Provided that the process can re-utilize the moulding material by breaking down the expendable moulds, and regrading the refractory particles, the higher cost of these materials should not unduly prejudice their use.

With regard to surface finish, it is true that sand moulds can never give as good a surface finish as investment moulds. This need not be discouraging if it is remembered that on many of the investment-cast levers, brackets, etc., the surface finish of the casting is better than is actually required and, furthermore, as the casting size increases beyond the range of investment casting, a rougher surface is likely to be acceptable if care is taken to use fine-graded sands. The binders used in precision-sand-casting must not be reactive to molten metal, must give adequate "green" strength, and must not create too rigid a structure, thereby causing hot tears in the casting as it solidifies. It is envisaged that the moulding should be carried out in very much the same manner as at present used in sand foundries, that is, sand mixing, moulding using squeeze-jolt machines, sand slingers, etc.

Before casting, it is expected that the moulds will be fired to at least 700 deg. C. to completely eliminate organic materials, and it is anticipated that the moulds will be cast at temperatures ranging from 200 deg. C. to any other desired higher temperature. The casting of hot moulds has two very clear advantages: (1) The air in the mould is already expanded before the molten metal enters, and (2) the solidification of the casting is much slower, thereby eliminating or reducing centre-line contraction. Economically, it may be argued that the firing of moulds is impractical, and expensive, but in the final analysis this is not necessarily true. It is well understood that nearly all steel castings undergo long and complex heat-treatment cycles, why should it therefore be considered expensive to put the mould through a heat-treatment cycle? After all, the present age is very much the age of electric power, and its application as a means of mould heating *in situ* should not be ignored.

The top gating of moulds has been shown to be a great asset in precision casting, in that it promotes progressive solidification. To amplify this point further, the metal running into the mould heats up

FIG. 7.—*"Blowing" plant with mechanized conveyor.*

FIG. 8.—*Hydraulic moulding plant with mechanized conveyor.*

the mould walls, thereby reducing the rate of solidification at those points. This is at a maximum at the top of a mould and a minimum at the lower extremities of the mould.

ALPHAX PROCESS OF PRECISION CASTING

The Alphax process has been developed at the author's firm, along the lines previously indicated, of combining the best features of the investment foundry with the versatility of the sand foundry. The process uses the sand-foundry technique of plate moulding, obtaining moulds of high delineation from hydraulic pressures up to 5 tons per sq. in. when pressing plastic sand with high cohesive properties. Using hot permeable moulds with an inorganic high-temperture binder, it closely follows the best practice of the Shaw and Investment casting process, and can be used to make castings in a wide range of ferrous and non-ferrous alloys.

Patterns

The process is designed to operate with patterns in wood, resin or metal, depending on the length of production run. If a prototype casting is required, wood patterns can be used to supply the designer with a few castings (Fig. 1). If, then, an order is placed, the full pattern equipment is made in steel, cast-iron, Kirsite or epoxy-resin, depending on the shape of the pattern and the strength of pattern required. Since the process frequently operates on short runs of 50 to 100 per annum, it is of great importance that the tooling should be as inexpensive as possible. In some cases, the pattern can best be machined from the solid, in others a wooden pattern is made with a double contraction allowance from which a casting made, followed by cleaning up and machining on important faces.

It is important that patterns have a good surface-finish and are free from surface blemishes, undercuts, etc. Provided this is achieved, the stripping characteristics of the pattern are excellent and no parting medium is required, other than intermittent application of French chalk or powdered talc. The life of the pattern is as yet unknown. Experience has so far indicated

FIG. 9.—*Plaster coreboxes, core, core mould for stainless-steel shackle, and castings. (High-temperature adhesive is being applied.)*

that no appreciable wear has occurred on metal patterns after the production of some 5,000 moulds.

Moulding Materials

The moulds are usually compounded from zircon sand with a water-base high-temperature phosphate binder. In all cases the sand and binder are mixed together until the desired state of cohesion and plasticity is reached. The sand is now plastic with high cohesive properties, more similar to glaziers' putty than to normal foundry sand. The life of the plastic sand on leaving the mixer is strictly limited; on exposure to dry air it will rapidly acquire a hard crust, and for this reason mixed sand is converted into moulds as quickly as possible.

Moulding Practice

The moulding methods employed are: (1) Hand or pneumatic ramming, using simple wood patterns; (2) hydraulic pressing, using metal or resin patterns, and (3) core shooting combined with hydraulic pressing, using metal or resin patterns.

Hand or pneumatic ramming is the only safe method to adopt when using simple patterns in hard or soft wood. It forms a conveniently simple and inexpensive method of obtaining prototype castings, and indeed for making the metal patterns for either (2) or (3).

Hydraulic pressing, using metal or resin patterns, has proved to be the most satisfactory method for either short-run or long-run production. Fig. 2 shows a patternplate for a clamp assembly which has no locators, since the mould half containing the cavities is bedded on to a flat block of sand. Fig. 3 shows the box being filled with plastic sand, and in Fig. 4 the sand is being compressed on to the patternplate, the pressure being transmitted through a suitably thick press-plate. Fig. 5 shows the mould being stripped on a special-purpose machine and Fig. 6 the complete half-moulds, together with the resultant casting. The finished clamp is shown clamping two tubes at right-angles.

The actual plant for core shooting combined with hydraulic pressing is shown in Figs. 7 and 8. This is virtually a mechanized version of method (2), having the following advantages: Stronger moulds; greater overall accuracy; elimination of hand packing; simplification of tooling, and faster production. Some experimentation may be necessary to establish which size of core-shooting box should be used. It is usual to assist the pattern leaving the formed mould by vibrating the patternplate. To effect this without destroying accuracy, the patternplate is allowed 0.005 in. freedom of movement vertically, whereas it is not allowed more than 0.002 in. movement horizontally.

Cores

To obtain the best properties from cores, it is often desirable to have good collapsibility without allowing any reaction with the molten metal. Cores can be made in Alphax material by pressure or ramming, but this necessitates metal coring-boxes which are expensive to manufacture. It is found that cores made by the Shaw process are ideal for use with Alphax moulds, since the collapsibility is excellent and coreboxes in plaster-of-Paris are easily made from wooden patterns. Fig. 9 shows shackle castings in a 45-ton steel, together wtih Shaw cores and Alphax mould. Originally, an Alphax core was used, but owing to its rigidity it caused the casting to open out and it became necessary to hand-set each component to the drawing dimensions. This was obviated by a Shaw-process core which, although relatively expensive as regards material, can easily justify its use on grounds of technical superiority. Fig. 10 shows a core assembly for a prototype steel component (Fig. 1).

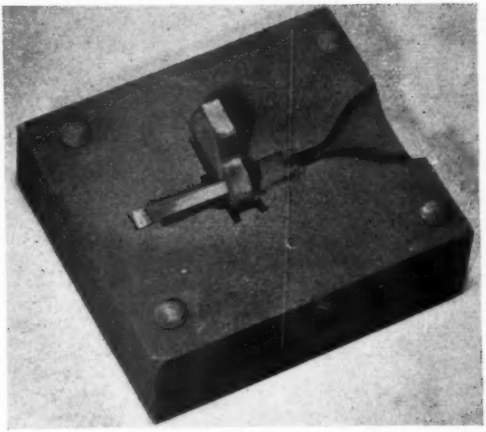


FIG. 10.—*Example of a core assembly.*

Assembly of Moulds

In processing the half-moulds after they have been pressed, it is important to realize that they are

FIG. 11.—*Gas-hardening plant.*

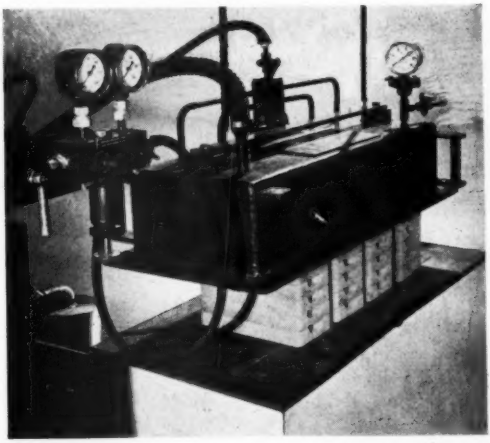


FIG. 12.—*Withdrawing moulds from furnace at 750 deg. C. with a jack-trolley.*

still plastic and that this fact may be used to advantage to ensure that the mould-halves bed accurately to give accurate register and absence of flash on the parting line. It is not advisable to assemble immediately after pressing, since there is too much plasticity to carry out this operation with safety. For this reason the moulds are left to "harden off" on a flat surface for an adequate length of time, say half-hour to two hours, dependent on size.

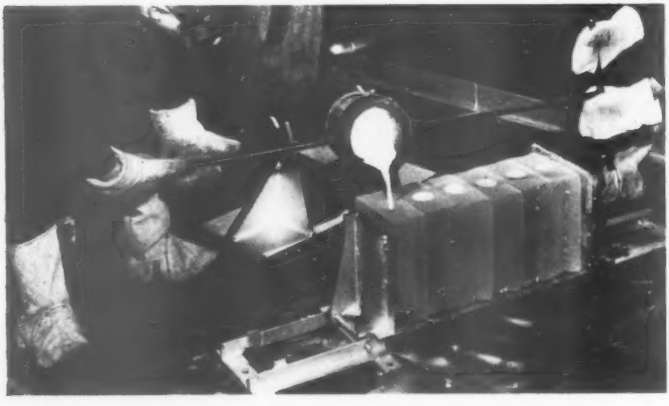
To avoid any possible movements which might upset the register during the firing and casting operations, a thin layer of high-temperature adhesive is spread along the mating surfaces, Fig. 9.

Setting of Moulds

Moulds can be set by three methods: (1) Air hardening; (2) oven hardening, and (3) gas hardening. In the main, air drying is used only prior to assembly, whereas (2) and (3) are used with suitable discrimination. Oven hardening is often used with complete satisfaction at temperatures between 110 and 150 deg. C. However, in cases where a core may be unsupported, gas hardening is invariably used. When a mould is exposed to oven temperatures, it is found that the moisture migrates to the centre of the mould, where it tends to increase the plasticity to a level high enough to cause mould collapse. The gas setting of a mould is achieved very simply on a perforated plate by allowing ammonia gas to permeate the mould under slight pressure of 5 lb. per sq. in., in which case it may take between 5 and 10 min. to set a mould. It is now found that moulds can be fired without oven drying being necessary. Alternatively, a gas-hardening plant may be used similar to that shown in Fig. 11. In this case the moulds are stacked inside a metal cover which is evacuated and filled with ammonia gas. By this means a number of moulds may be set in 5 min. process time.

Firing and Casting

In general, it is found best to follow the practice of the investment-casting process and to fire moulds up to 750 deg. C. This purges the mould of any injurious organic matter and gives it adequate permeability. In the casting of some non-ferrous metals this is not necessary, and moulds can be poured without firing at 110 deg. C. Notably this practice can be used with non-ferrous alloys. Since firing at 750 deg. C. is necessitated in the sand-reclaiming cycle, in these cases the sand is fired after casting. To enable easy manipulation of moulds in the gas-fired furnace, the moulds are positioned on 9-in. x 3-in. steel channels which are carried in and out of the furnace on a suitably designed jack-trolley. Fig. 12 shows a number of moulds being withdrawn from the furnace at 750 deg. C. Where the moulds are gated through the parting line, two main line methods are used to position the moulds for casting: (1) The moulds are stacked into a clamping rack, and then cast with the rack in a horizontal position, Fig. 13; (2) the moulds are clamped into a rack built into any electric furnace, in which case the heating elements are built into the furnace cover which is removed when casting the moulds.



It is unusual for the moulds to be cast at 750 deg. C. to obtain optimum results, and temperatures from 200 to 500 deg. C. are usually adopted. Some advantage is found in the excellent casting characteristics embodied in zircon sand, and its relatively high thermal conductivity. In general, it is found that moulds can be top-poured with a high degree of success in much the same manner as investment moulds.

FIG. 13.—*Pouring cast iron into a group of clamped moulds.*

Castings

Alphax castings are made in steel, cast-iron, bronze, brass or aluminium. In all classes of castings, the main object has been the elimination or reduction of man-machine-hours. This aspect is shown at its best in Fig. 14, where a clevis is shown (*a*) machined from the solid, and (*b*) machined from a casting, with a saving of 117 min. per component. Further to this has been the use of the process to eliminate much of the complication in sub-assemblies by substitution of a number of castings dimensionally interrelated. Fig. 15 shows a sub-assembly of machined castings and components machined from solid, riveted and pinned together, whereas Fig. 16 shows the assembly of cast components which is designed to replace it. In many cases the final finish is added to the cast component by a subsequent operation. For example, bronze components with fine serrations pressed into the area surrounding the slot, gave a result which was far better in definition and precision than a casting where the serrations had been cast in.

With regard to holes, it is preferred in many cases to drill these in the castings afterwards, particularly in those cases where the depth of hole is greater than the diameter. It is often found useful to cast dimples in the components to this end, though this can only be done in cases where the centre tolerances are uncritical. The terminal end shown in Fig. 18 is a good example of this; the casting, and the final machined and assembled component, are shown.

Often holes are cored in castings for the reason of progressive solidification with the avoidance of thick sections. Much advantage can be gained economically in the use of cast iron. For example, the large end cap shown in Fig. 19 was previously machined out of solid steel. Since the metal thickness around the cap is only $\frac{1}{8}$ in. it provided a difficulty for conventional sand founding. Comparatively thin-section levers, etc., are also possible by this method.

ECONOMICS OF THE ALPHAX PROCESS

The costs of Alphax castings lie between investment casting and sand casting, but it is difficult to establish its final position at the present stage in development. The work it is doing at the moment is concerned with the manufacture of component

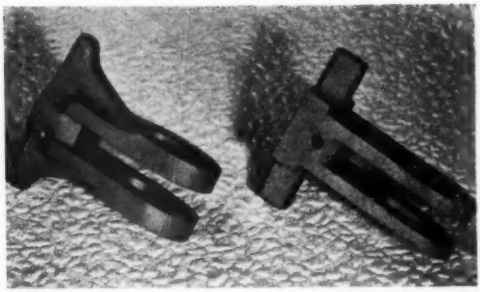
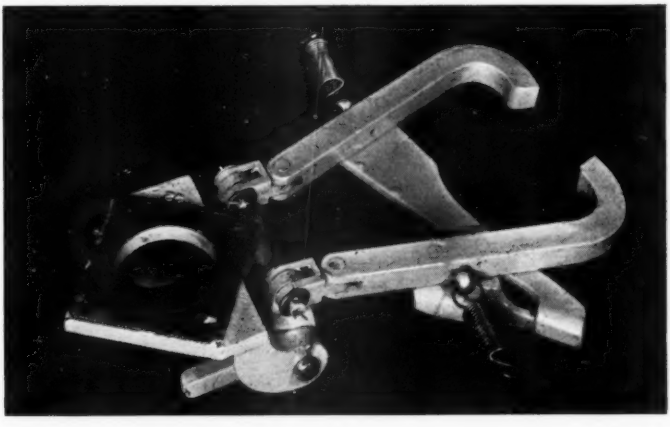


FIG. 14.—*Illustrated are (left) a clevis machined from solid mild steel, and (right) a similar clevis made in the form of an Alphax casting in stainless-steel.*



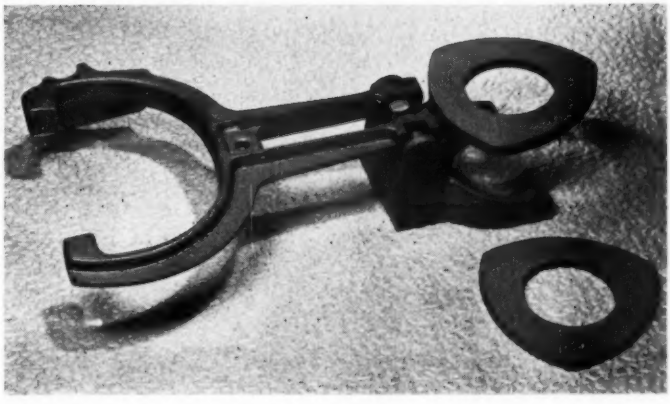


FIG. 15.—*(Above) Sub-assembly of machined castings, and machined-from-solid components.*

FIG. 16.—*(Below) Sub-assembly of cast components.*

batches, seldom exceeding 100 per annum, and it is quite clear that it can hold its own on this basis in competition with other methods of production. Basically, the economics of the process depend on the following factors: (1) Cost of patterns and patternplates; (2) sand utilization factor; (3) elimination of unnecessary labour costs; (4) scrap percentage; (5) amount of fettling required, and (6) yield.

(1) The cost of patterns and patternplates is likely to be reduced by improved methods of making metal patterns, or by improved methods of shape production in suitable chosen materials, and conversion to resin as a secondary operation. The cost of patternplates and locators is purely secondary, since this is largely dependent on drill plates, etc., to provide standardized plates at low cost.

(2) Sand utilization factor means the ratio of volume of sand to the volume of the casting. This is at its worst in the case of match-plate moulding, and at its best when stack moulding or equivalent methods are used, as in Fig. 20.

(3) Labour costs can be avoided, in moulding, by the methods outlined, in combining the core shooting of plastic blocks with the pressing of half moulds; in casting, by using the best possible melting facilities.

(4) The scrap percentage is now around 10 per cent., but it is found that improved processing can effect reductions. The main casting defects are not usually inherent in the process itself.

(5) The amount of fettling required is dependent on the accuracy with which the process is carried out, *i.e.*, the worse fitting is the core, the more the consequent fettling. Also, metal poured too hot makes more work. Better machinery and tools can also reduce fettling times, *e.g.*, great accuracy can be achieved in re-

FIGS. 17, 18 AND 19.—*Selections of brass, bronze, and cast-iron castings respectively.*

moving up to 0.015 in. using an abrasive-belt grinder.

(6) All casting processes depend on the yield, that is the percentage of the cast mass represented by the finished component. Much depends on the use of existing foundry knowledge and the best method of casting the job. The yield obtainable in Alphax is very similar to investment casting, approximately 50 per cent. Stack-moulding techniques, however, have shown improved yields.

CONCLUSIONS

Once the development of a casting process is completed, there remains the question of how to find work for the new process to do. This has never been satisfactorily achieved by searching the machine shop for suitable shapes, and then trying to persuade the designer to convert the machined-from-solid component to a casting, because the machined-from-solid design, when cast, very often offers the founder little opportunity of obtaining progressive solidification, and furthermore production departments are often unwilling to run two sets of spares for any particular design or apparatus. Many thousands of Alphax castings are now being used in industry, because the designer not only has confidence in the method, but also appreciates the advantages which castings can offer over machined-from-solid components, which are:—(1) Equal strength in all directions due to an equiaxed crystal structure; (2) greater dimensional stability, free from the distortion which occurs when machining a rolled or forged shape; (3) availability of a wide range of material giving great diversity of mechanical properties, such as: (*a*) corrosion resistance; (*b*) heat resistance; (*c*) high degree of hardness and toughness, and (*d*) good subsequent machinability; (4) reduction or elimination of machining; (5) great freedom of shape in design, and (6) prototype castings available at low tool costs.

With regard to the above advantages, it must be stressed that no designer will ever have complete confidence in any casting process which cannot assure him metallurgically sound castings, and in the experience of the author, this has been obtained in the Alphax process by: (1) All designs of castings having to be based on directional progressive solidification; (2) provision of non-reactive mould surfaces which can be cast hot or cold to suit optimum casting conditions, and (3) use of best possible inspection procedure.

In all this work on the Alphax process, the author can see only a beginning, for, after all, there is nothing particularly new about the process, unless it is the selective use of materials and adherence to sound principles in the manufacture and use of moulds. Further to the development of moulds, the whole question of patternmaking is seriously in need of review. In the production of machine tools for the making of patterns, little progress has been made in comparison to the machine tools produced for basic engineering requirements. It is essential that progress be made in finding suitable alternatives to wood for pattern materials by using, for example, the many casting resins which have recently become available. In the field of liquid metal-melting many of the techniques of vacuum degassing will doubtless find their right and proper place in providing purer metal, thereby increasing the mechanical properties of the castings, as well as their castability.

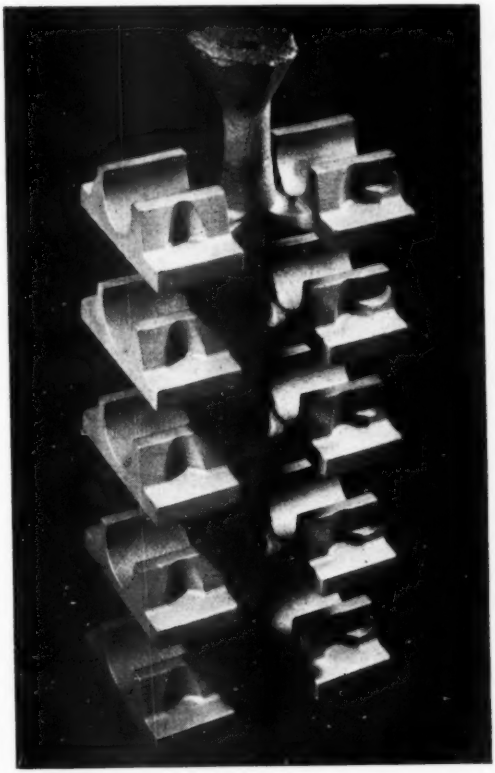


FIG. 20.—*" Tree" of castings resulting from stack-moulding.*

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"Quality" as well as "Quantity" says Mr. Whipp . . .

As probably every other aspect of the foundry industry had been presented by the addresses of previous presidents, Mr. A. M. Whipp, in his remarks at the opening meeting of the East Anglian section of the Institute of British Foundrymen, chose to deal with a subject which in his opinion had always been one of outstanding importance in the industry. It was a subject which was unfortunately often overlooked by many companies and one in which he personally as a foundry and engineering inspector* took special interest, namely, "Quality Control."

The leader of a recent trade delegation from Canada to this country, Mr. Whipp recounted, was amazed at the high quality of work produced by the British craftsmen in works that they had visited, and asked why more firms did not maintain this high standard, especially on products for the export market. Here the president felt the answer was that many firms went "all out" for higher unit production and so overlooked the standard of quality. In his opinion, the aim of all foundrymen should be the highest quality casting allied with high production, and then the reputation of foundries and the industry throughout the world as a whole would be assured.

Departmental Responsibility

Final inspection of castings by viewing and by dimensional checking was not enough. Quality control by checking and testing must be carried out through all the stages of manufacture, Mr. Whipp continued. Raw materials were the responsibility of the foundry laboratory. Sands for moulding and coremaking, refractories and metal melting, must come under the control of the chief metallurgist. Patternmaking, casting and feeding techniques, moulding boxes and the production of moulds were items that must be carefully designed, planned and recorded by the firm's methods department, under the supervision of the foundry manager. The laboratory and the inspection departments should necessarily co-operate in the testing and control of the physical and chemical composition required by the various specifications.

Finally, he said, the works inspection department must take full advantage of the modern methods of non-destructive testing available, in convincing the customer that the castings produced would meet his requirements in service; that valuable machining hours would not be wasted on scrap castings and that the foundry departments were co-operating in the manufacture of high-quality products.

All could see the foundry industry had had to move in step with engineering, through the ages of steam, electricity, jet propulsion and now atomic power. New metallurgical problems had been presented to the foundryman, as new inventions were evolved from each age. Thus, the company prepared to tackle what might seem to be the impossible from a casting angle, and where full advantage was taken of the scientific and technical knowledge available, and where modern methods of testing and inspection were adopted, must eventually acquire a reputation for producing high-quality castings.

Future

What is to become of the industries' reputation in the future? Mr. Whipp asked. Who is to accept the challenge of the scientific designers and engineers, and what have we in the foundry to offer the young man of to-day? These were questions that are being asked by the older men who have spent most of their working days building up and maintaining an industry they admire.

In Mr. Whipp's opinion, the industry's reputation would remain secure, because all sections of founding will continue to advance. Great strides, both from the foundry and metallurgical aspects, had been made by the manufacturers of castings of all types. The research workers in the bronze, iron and steel sections of the industry, were answering the challenge of the designers by aiding the metallurgist in producing the highest quality metals to withstand always greater temperatures and stresses.

Young men would be tempted into the industry as long as modern foundries continued to become mechanized, Mr. Whipp concluded, for the fully mechanized foundry could only be maintained by adequately trained technicians, if full benefits were to be realized. Thus, the foundry student of the future would have to be an engineer as well as a foundryman. The staff of enlightened foundries had every right to derive satisfaction from their work, and the industry offered great opportunities to young men seeking a technical career. A high standard of quality might take many years to build up, and unless the foundry took full and continuing advantage of the technical knowledge available, a company's reputation for high-quality castings could quickly be lost.

* Mr. Whipp is associated with Lake & Elliot, Limited.

Higher Technological Award

To encourage qualified men and women to undertake further study beyond the level of the Diploma in Technology and carry out original investigations, the National Council for Technological Awards have decided to create a higher award. The intention is that this award shall be a mark of outstanding distinction granted to a student who has proved his ability by completing a substantial programme of work demanding the application of his knowledge to the solution of a problem of value to industry.

The Council will establish a college of technologists, to be known as the College of Technologists, and the new award will take the form of membership of this College (MCT). To qualify, a student must undertake a programme of work to be carried out jointly in industry and at a technical college. This programme may be concerned with any technological aspect of industrial activity, such as research, development, design, production or market investigation. The Council believe that to carry out successfully post-diploma work of this character, students must remain in contact with industry or with commercial laboratories.

Procedure and Scope

Before starting on such a programme a student must apply to the College of Technologists, through the technical college at which he will study, to be registered as a candidate. The College will consider particularly the qualifications and experience of the student, the suitability of the programme offered, and the arrangements to be made for carrying out the work both at the technical college and in industry.

There may be cases where it would be more appropriate for a holder of the Diploma in Technology to pursue his studies at a university, and the committee of vice-chancellors and principals has strongly recommended to universities in the United Kingdom that, in suitable cases, holders of the Dip. Tech. should be on the same footing as holders of first degrees when application for admission to courses of study for higher degrees are being considered.

European Foundry Apprentice Competition

Background Information and Detailed Arrangements for this Year's Event in Bezons, a Suburb of Paris, from November 24 to 29

The originating point of the European Foundry Apprentice Competition was the formation, in 1952, of the European Committee of Foundry Associations. The aims of the Committee, as laid down by is founder members, are generally speaking to support and promote the interests of the foundry industry at all levels, and to study particular problems affecting the foundry industry as a whole. The method chosen to carry out these aims was to form sub-committees, each dealing with one particular field of interest. One of the earliest sub-committees to be formed was that to deal with training and recruitment, subjects arousing as much lively interest on the Continent as in this country.

Original Proposals

The proposal for an international apprentice competition was first put forward by the chairman of this sub-committee at a meeting of the full European Commitee held in October, 1956. No definite decision was taken at the time, but when the matter was brought up again at a meeting of the same body in April, 1957, it was decided to endorse the project. The German founders' organization, the *Wirtschaftsverband der Giesserei-Industrie,* started planning for a competition immediately thereafter, to be held in Stuttgart in November, 1957. It should be noted that the idea behind promoting this competition was to arouse interest in the foundry industry among those outside it, and thereby to increase the numbers of young people wishing to enter the industry, so that good applicants would be available for recruitment at all levels. There was also the thought behind it that nothing but good could come out of young apprentices meeting their opposite numbers in other countries, and possibly giving each other a fresh outlook on their work.

The United Kingdom agreed at once to take part in the competition. The immediate problem was to select at quite short notice three apprentices worthy of representing the United Kingdom. This was not an easy matter, as no machinery existed through which such a selection could be made. For several of the Continental countries, a selection process of this type presents no such difficulties, as there exists a unified national system of examinations which apprentices take before they qualify as skilled craftsmen. All these countries, therefore, had only to select the three leading apprentices as revealed by the results of examinations they had already taken. Time being short, the United Kingdom apprentices were selected by nomination from firms and other bodies, followed by a brief practical test and interview. The industry was indebted to the Institute of British Foundrymen for organizing this procedure. It was not pretended at the time that this method would necessarily result in the emergence of the three apprentices best equipped to take the tests, although in the event the three chosen acquitted themselves creditably. But it was strongly felt that participation was of greater importance than winning. (This year's competitors from UK are shown in Fig. 1.)

Competition Details

Meanwhile, the members of the sub-committee had to work out the details of the competition itself. It was agreed in the first instance that it should consist of a substantial test in moulding and core-making practice, and written tests in drawing, calculation and foundry technology. The practical test was allotted approximately 60 per cent. of the total marks. Each country was asked to submit subjects for the tests, and when this had been done the final selection was made by drawing lots. The Germans, as host country, undertook the manufacture of the necessary pattern equipment. Each country was

FIG. 1.—*The UK apprentices taking part in this year's competition in Paris; left to right, Michael Tobin, Peter Warnes and Denis Perkins.*

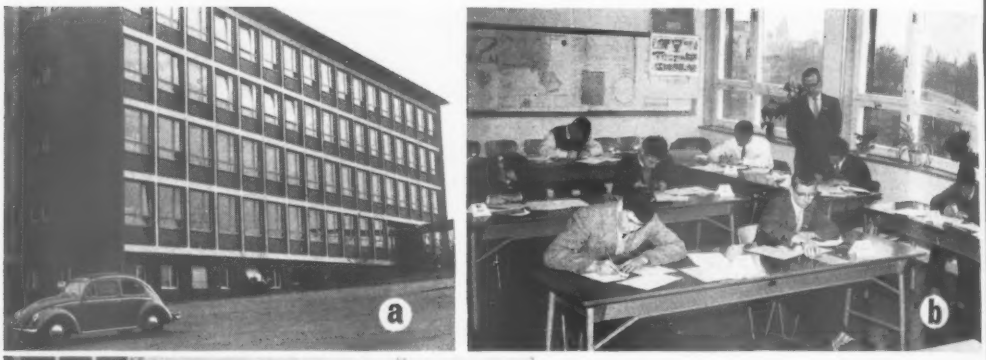

FIG. 2.—*Last year's European foundry apprentice competition held in Stuttgart, Germany; (a) External view of the college where the competition was held; (b) written examination in progress, and (c) scene during the practical test.*

allowed to nominate three judges; and M. Guérin of France was chosen as chairman of the judges.

It is easy to compress the taking of these decisions into a single paragraph, but they did in fact involve a great deal of work for all concerned. The tests had to be suited to ferrous and non-ferrous candidates, and of course each candidate had to have papers in his own language. Indeed, it was surprising, and a tribute to those concerned, how smoothly things went.

Last Year's Event

The competition took place at Bad Cannstatt, near Stuttgart, in a technical college (Fig. 2). In the space of four days, the competitors carried out the practical test occupying sixteen hours and also the prescribed written tests. There were fourteen competitors in all, two working in aluminium and the remainder in grey iron. Each had to produce, from identical patterns and coreboxes, an engineering casting weighing approximately 56 lb. Marks were awarded in the practical test both for the way in which the job was tackled and also the appearance and commercial value of the finished product. The marking of the written papers involved translating all the competitors' papers into four languages, English, French, German and Dutch.

When the competition was concluded, consideration was immediately given by those concerned in the United Kingdom to what value it had, and what the results implied. The first question was whether the competition could simulate better recruiting in the foundry industry. The general opinion in the British foundry industry was that the status of the industry was enhanced by holding such a competition, particularly as it was competently run, and that it showed that the industry was not parochially minded. The second question was, what did the placings of the British candidates prove, if anything. In the final adjudication, comprising both the practical and theoretical tests, they were placed ninth, tenth and thirteenth. In general they scored better in the theoretical than the practical tests.

Reflections

It was felt that to draw sound conclusions from a single competition about systems of apprenticeships in different countries, particularly in view of the varying methods of selection employed, was impossible. One point which emerged was that several of the Continental apprentices seemed more mature in the way they dealt with their written tests, and that perhaps their general standard of education was higher. The fact that the first six places were filled by German and French competitors, both of which countries have nationally agreed standards which must be attained before the apprentice can become a fully skilled worker, naturally caused a great deal of hard thinking. However, one competition is little to go on, and of course the fact that a country can produce the best two apprentices under those circumstances is no proof that the system under which they have been trained is the best for the industry in general.

Shortly after the competition, it was agreed by the European Committee of Foundry Associations that a second international meeting should take place in 1958, and that France would be the host country. In order to make as certain as possible

that the United Kingdom competitors chosen would be the best available, it was decided that a domestic committee should be set up, representative of all branches of the foundry industry, with the object of organizing United Kingdom participation in the European Foundry Apprentice Competition. There came into being, therefore, early in 1958, the "Organizing Committee for the United Kingdom for European Foundry Apprentice Competition," with as its members two representatives each of the Institute of British Foundrymen, the Association of Bronze and Brass Founders, the British Steel Founders' Association, the Council of Ironfoundry Associations, and the Light Metal Founders' Association; and one co-opted member, the Head of the National Foundry College (Mr. J. Bamford). The tasks of the new committee were to put forward proposals for the various tests; to bring the competition to the notice of all eligible foundry apprentices; and to select three competitors and three judges to go to Paris.

Selection of Candidates for 1958

The most laborious task was the selection of the three candidates for 1958. The initial step was taken by informing over 2,500 foundries that the competition was to be held, and asking them to nominate apprentices within the specified age-limit whom they considered to be suitably equipped to take part. The general requirements were that the apprentice should have reached a standard of technical knowledge approximating to the City and Guilds intermediate certificate in foundry practice, and be capable unaided of practical work of a high standard.

Thirty-two candidates were appoved to take the initial test—written papers in foundry technology and drawings. These were held early last June in different regional centres under the auspices of the Institute of British Foundrymen. After the marking of the answers—carried out by a small committee co-opted by the Organizing Committee—six iron-founding and two steel-founding apprentices were selected for the next stage, a practical test, which it was hoped would enable the selectors to find the three best candidates. However, after the holding of the practical test the judges were unable to separate the top four candidates, so the decision was made to give the four "short-listed" candidates a few weeks of practical training and decide at the end of that time which three should go forward to Paris.

The Chosen Three

The final selection was made at the end of October, and the three apprentices who are going to Paris are:—Mr. Denis Perkins (Stanton Ironworks Company, Limited, near Nottingham); Mr. Michael Tobin (Metropolitan-Vickers Electrical Company, Limited, Manchester), and Mr. Peter Leslie Warnes (English Steel Castings Corporation, Limited, Sheffield) (see Fig. 1). Mr. John Alan Littlewood (W. & T. Avery, Limited, Walsall) who was a very close runner-up for the team and is being considered the official reserve, may count himself unfortunate that the number had to be limited to three.

The selection of the three judges very soon came down to asking the three gentlemen who had officiated in that capacity at Stuttgart to perform the same function again. Mr. J. W. Gardom, Dr. J. G. Pearce, C.B.E., and Mr. J. Bamford were good enough to agree to do so, and will therefore be in Paris with the three chosen apprentices. It is perhaps of interest that at the last competition the British judges were inclined to mark all the competitors more strictly than their colleagues from other countries, so that the United Kingdom candidates need not fear that they have been judged to lightly during the selection process. In addition, Mr. G. H. Charsley, director, Trent Foundries, Limited; Mr. W. S. Matthews, training officer, Stanton Ironworks Company, Limited; Mr. Frank Shepherd, director for personnel, Head, Wrightson & Company, Limited, and Mr. F. C. Hayes, who is joining the CFA shortly as training officer, will be present as observers.

All that remains is to wish the competitors the best of luck on November 24, when the five-day competition starts. Naturally those who have been concerned with the organization at the British end hope that the United Kingdom candidates will prove themselves to be the best there. But it remains true, as in the first competition, that the most important thing is for the UK to be participating in this expression of European foundry amity.

ISI Translations

From amongst the most recently published lists of translations available from the Iron & Steel Institute (4 Grosvenor Gardens, London, S.W.1), the following have been selected as being of interest to founders. The price quoted is that for single copies, postage extra, there being reductions for quantities ordered. Readers writing for translations, or for further information, should mention this JOURNAL when doing so.

891 R. HROCH and A. KOVAL: Casting of Steel Rolls for Blooming Mills. *Slevarenstvi (Prague)*, 1957, vol. 5, June, pp. 161-168. (£5.)

959 L. BEAUJARD and V. HUSAREK: Some New Equipment for Continuous Non-destructive Control of Metals. *Métaux*, 1957, Dec., pp. 459-468. (£4 10s.)

982 SHIMANAKA, K., *et al.*: On the Desulphurization of Molten Steel by CaC, and CaO. *Tetsu-to-Hagané*, 1956, Sept., pp. 864-865. (£1.) Abstract: In steel deoxidized by aluminium, CaC, reduces the sulphur content to approx. 0.002 per cent., while CaO only brings it to 0.01 per cent. but in a slightly shorter time.)

1002 H. MIETH: A Comparison of the Performance, Lay-out and Cost of Different Works Railway Systems of German Foundries supplemented by Mathematical Statistics. (£5.)

1034 H. BUHLER: Development of High-strength Steel Castings of Large Wall-thickness. *Giesserei*, 1958, Feb., pp. 87-92. (£3 5s.)

1039 S. N. GUBKIN and I. A. ISVAIGEL: Deformation of Bronzes, subjected to Pressure. *Izvestiya Akad. Nauk. Otd. Tekh. Nauk*, 1954, Jan., pp. 128-137. (£2 15s.)

1081 LEVELINK, H. G.: Some Characteristics of Waterglass as a Binder for Moulding and Core Sands. *Metalen*, 1957, Oct. 31, pp. 406-412: Nov. 15, pp. 442-444. (£5.)

1089 NIKLAS, L.: New Method for Thickness Measurement (Ultrasonic Velocity Measurement). *Z. Metallkunde*, 1958, March, pp. 152-155. (£2 10s.)

A translation in course of preparation is:

1110 KOCH, W., *et al.*: Highly-sensitive Determination of Sulphur and Simultaneous Determination of Carbon and Sulphur with a Conductivity Recorder. *Arch. Eisenhüttenwesen*, 1958, Sept., pp. 543-546.

(If any reader knows that this paper has already been translated, it would be appreciated if he would inform the Editor of the JOURNAL.)

American Letter

Aluminium-alloys Forecast

The bottom of the recession in production of aluminium-alloy castings appears to have passed and producers are predicting substantial improvements in 1959, though in some quarters their forecasts are regarded as somewhat optimistic. In the opinion of E. M. Strauss, Jr., manager of commercial research, Aluminium Company of America, American aluminium producers will despatch from 15 to 20 per cent. more aluminium next year than during 1958. Looking ahead, he predicts that building and construction will continue to be the leading aluminium market, absorbing about 485,000 tons, and that the transport industry (which includes automobiles) will use 370,000 tons. Further estimates are that (1) containers and packaging (including foil) will consume about 110,000 tons; (2) consumer durable goods, ranging from cooking utensiles to furniture, will require 250,000 tons; (3) the electrical and communications industry will use 200,000 tons; (4) non-electrical machinery and equipment will take 220,000 tons, and (5) aircraft and missile uses will account for 110,000 tons.

Annual Meeting of Marine and Power Engineers

Approximately 140 visitors, including a party of 12 from overseas, shown in the photograph reproduced below, attended the sixteenth Marine and Power Engineers' Group meeting, arranged by the International Nickel Company Incorporated, at Wrightsville Beach, North Carolina, USA, during the week beginning September 22, 1958. Following an inspection of the corrosion-testing stations at Harbour Island and Kure Beach, seven informal, but extremely interesting, discussions were held. The discussions dealt with current corrosion problems, covering the effects of galvanic and stray current corrosion, cavitation erosion and impingement attack, and modern methods for overcoming these effects on hulls, evaporators, condensers, pumps, propellers, and power units, etc. Prior to the Wrightsville Beach programme, the visitors from overseas were conducted on a tour of shipyards and marine-equipment manufacturing establishments, where demonstrations of prevailing shipbuilding procedures were given. Castings play an important part in this field, and it is hoped to publish shortly, in the JOURNAL, a full report by Mr. Frank Hudson, of Mond Nickel Company, Limited, on matters of foundry interest which arose during the meeting and tour.

Conferences

A survey of two recent conferences is given below. The papers listed are those which were of interest to foundrymen.

All-Canadian Foundry Conference, held at Hamilton, Ontario, October 16-17: "Light Metals *versus* Ferrous Metals," by H. E. Gravlin; "Is Quality Control Old Stuff in the Foundry?", by W. K. Bock; "Pouring and Gating of Green-sand and Shell Castings," by J. F. Orloff; "Science at the Service of the Canadian Foundry Industry," by S. L. Gertsman, and "Moulding Sand Control," by A. N. Johnston.

National Foundry Association 60th Annual Meeting, held in Chicago, November 20-21: "Labour Negotiations in the Foundry Industry—1959," by Charles T. Sheehan, NFA executive secretary, and "A Successful Foundry-safety Programme," by W. G. Greenlee.

This group of participants in the annual meeting of the Marine and Power Engineers includes 12 visitors from overseas (out of the 140 delegates who attended).

From left to right, they are:—Mr. J. L. Cahill, shipyard welding engineer, New York Naval Shipyard; Mr. I. Massenti, of Ansaldo Cantieri Navali, Genova-Sestri, Italy; Mr. E. M. H. Lips, of Lips N.V., Drunen, Holland; Mr. V. Zagnoli, Ansaldo Fonderia Ghisa et Metalli, Genova-Multedo, Italy; Mr. F. A. Badia, metallurgist, INCO; Mr. G. L. Lee, metallurgist, INCO; Mr. G. F. Geiger, metallurgist, INCO; Mr. F. Crum, American Bureau of Shipping, New York City; Mr. F. Yesilkaya, commander in the Turkish navy (stationed at present in the New York Naval Shipyard); Mr. A. M. McConnell, of G. & J. Weir, Limited, Cathcart, Glasgow; Mr. G. L. Bravo, Sociedad Espanola de Construccion Naval, Bilbao, Spain; Mr. J. Arnott, G. & J. Weir, Limited; Mr. A. P. Wright and Mr. T. M. Billington & Newton, Limited, Hanley, Stoke-on-Trent; Mr. F. Hudson, Mond Nickel Company, Limited, London, and Mr. R. C. Pearson, New York Naval Shipyard.

Equipment & Supplies

Beryllium/Copper Addition Alloy

From the Beryllium Smelting Company, Limited, 36/38, Southampton Street, London, W.C.2, comes the following report of the use of beryllium/copper master alloy as an additive to red brass for improving castability and reducing the percentage of rejected material. A foundry which had been previously using a small amount of phosphorus to improve castability of this type of metal, as an experiment, added 3 lb. 6 oz. of the beryllium/copper master alloy, containing 3.85 per cent. beryllium, to 135 lb. of red brass B (ASTM specification B-30-54-49). In this case phosphorus copper was not added. The temperature at the first cast was 1,039 deg. C. and that of the final one 1,008 deg. C. (Normally castings at this foundry must be poured between 1,149 and 1,093 deg. C.) In the experiment, the results were such that the last cast at 1,008 deg. C. resulted in ten castings out of 12 coming out in excellent condition whereas according to previous experience, the last cast without beryllium would have been a complete loss. Of the total 72 castings produced from the whole melt only four were rejected, and these were from the final pour at the lowest temperature.

Shotblast Machine

The Hepburn Conveyor Company, Limited, recently held a two-day "open house" at their Ings Road Works, Wakefield, to demonstrate the Pangborn Rotoblast model of shotblast plant, equipped with a model CM dust-collector unit designed by the same firm (Fig. 1). This equipment is now made by the Wakefield concern under licence, and the JOURNAL's representative who attended the demonstration reports that its construction is up to the high-class engineering standard so long associated with the firm's range of plant for foundries.

The plant being demonstrated was erected at floor level (not fastened down). It is so designed as to deal with castings arriving straight from a moulding shop, in about 1-ton elevator-bucket loads at a time, according to bulk and variety. The cleaning cycle is practically automatic, a push-button panel being used to control the sequence of operations.

Those attending this demonstration were able to witness a 15-min. operational run, which showed that approximately 17-cwt. of sizeable, thickly-rusted, bearing-block castings taken from a stockyard (and having deeply-cored parallel-sided recesses) were well and truly cleaned. Moreover, the castings used in the demonstration had patches of the original moulding and core-sand weathered on to the surface. Examination of these castings after treatment indicated that the surfaces were "equal to new" and ready for the machine shop. It was clear that all faces and cored sections had been tilted, in turn, under the impact of the stream of shot.

The main component of the plant is an endless heavy-duty conveyor (replacing the conventional hollow cylinder of a barrel-type shotblast plant) which tumbles the castings over and over under the stream of abrasive shot ejected from an impeller wheel designed to throw up to 70 tons of abrasive per hr. Special features are made of simplification in blade removal from the impeller wheel, highly-effective sealing of bearings, and interlocks to prevent inopportune opening of the cabinet.

General observations made by the JOURNAL's representative include the remarks that there was a complete absence of vibration on the plant, and much of the noise, inseparable from the old-type rumbler barrel, was cut down by virtue of good design; the spill-out of sand was entirely free from shot; dust itself was well taken care of by the extraction unit, and there was no leakage from the plant. It appeared that those troublesome micron-size dust-particles of "face-powder" fineness were intercepted by the close-weave cloth filters of the separate dust-collector.

Casting Shaker

The "Quickway" shaker was originally designed (by Steele & Cowlishaw, Limited, Cooper Street, Hanley, Stoke-on-Trent) for rapidly rejuvenating paint and other stored liquids and has now been found to have a specific foundry application. A certain Yorkshire foundry, producing a small casting with some intricate cored holes, found that it was impossible to clean this out properly by normal methods of shot-blast, air-blast, washing, etc., and the following method was developed. After the rough removal of the sand core, the interior passages were partly filled with steel balls of $\frac{1}{16}$ to $\frac{1}{4}$-in. dia., the various openings temporarily plugged and the casting, with the balls inside it, was placed in the jaws of the shaking machine, as shown in Fig. 2. After a few-minutes' treatment, it was obvious that the violent agitation of the steel balls in the core passages had completely removed any adhering sand and the metal surfaces were quite highly polished. All that remained was to remove the plugs and let the balls

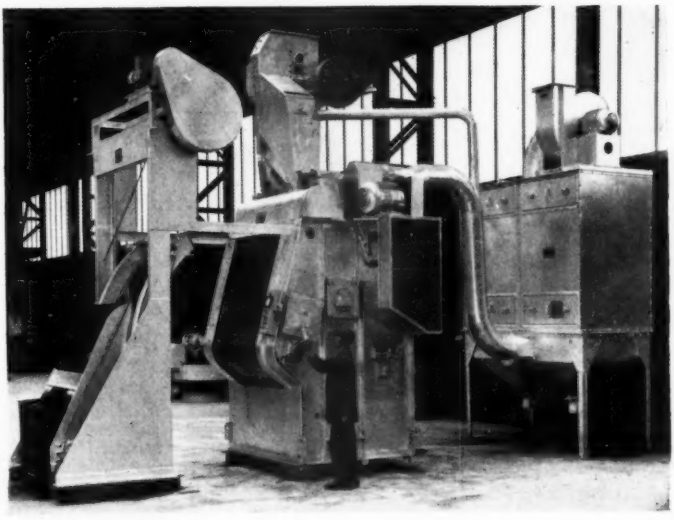

FIG. 1.—*"Pangborn" barrel-type shotblast plant coupled direct to a dust-extraction unit, as supplied by Hepburn Conveyor Company, Limited, to Mavor & Coulson, Limited.*

FIG. 2.—*Shaking machine (made by Steele & Cowlishaw, Limited) adapted for cleaning the cored passages of an intricate casting.*

run out again. The entire trial was so successful that the installation of machines in the foundry was decided upon.

Electro-magnetic Separator

Industrial Magnets, Limited, Acocks Green, Birmingham, 27, have introduced a new type of overband electro-magnetic separator. The purpose of this separator is to provide automatic separation and discharge in continuous plants—particularly sand plants—where the band conveyor or vibratory feeder-type of carrier is in operation. The separator consists of a robust steel frame, housing a heavy-duty totally-enclosed magnet unit. Steel idler pulleys, running on ball-bearings, carry a heavy-duty rubberized conveyor belt fitted with moulded and riveted slats to assist in the discharge of extracted iron. Under normal operating conditions, the separator is mounted across the main conveyor (Fig. 3). "Tramp" iron is attracted to the belt travelling across the magnet face and adheres to this until the belt leaves the magnet, automatically discharging the extracted iron clear of the main conveyor and into a discharge chute. All intervening space in the magnet unit is filled with a special heat-conducting compound, rendering the entire unit impervious to moisture and there is reported to be virtually no flux leakage. The separator can be employed for the extraction of loose iron and steel and other ferrous material with magnetic susceptibility from plastics, slag, etc., in addition to foundry sand.

FIG. 3.—*Electro-magnetic overband separator, made by Industrial Magnets, Limited, shown installed crosswise over a foundry sand conveyor.*

Monorail Hoist

At an exhibition, the JOURNAL's representative inspected a piece of French-made equipment from the firm of Etablissements Tourtellier, 14, Avenue de Lutterbach, Mulhouse (Haut-Rhin), France. It was a monorail-mounted electric hoist with manual movement, the schematic arrangement of which is shown in Fig. 4. It can be seen that there are no exposed "live" wires, as the whole of the suspension gear for the rope barrel is enclosed in a specially profiled steel section comprising the monorail on which the hoist travels and which, it is stated, can be erected and dismantled easily. The control is effected from a suspended push-button panel, at hand level. The dust-protected lifting apparatus is known as Monelec as it is of a patented design. Further details are available by writing to Mr. Petiteau at Mulhouse.

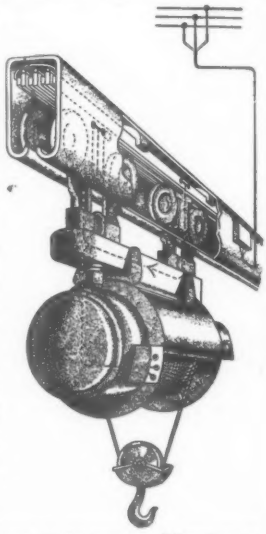

FIG. 4.—*Schematic arrangements of the monorail - mounted pulley block, manufactured by Etablissements Tourtellier, Mulhouse.*

THE INTRODUCTION of a new light-weight air-hose for use with their "baby" L900 spray gun is announced by Alfred Bullows & Sons Limited, Long Street, Walsall. This is a rubber hose covered with rayon braid and has a bore of $\frac{5}{32}$ in. It is lighter, more flexible and gives greater ease of handling than the standard type hose; it is also less expensive.

A weight comparison between 10-ft. lengths of the new hose and connectors and $\frac{5}{16}$-in. diameter hose and connectors shows the ratio of $5\frac{1}{2}$:25.

Safety Training Courses

The Industrial Safety Training Centre operated by the Birmingham and District Industrial Safety Group continues to grow in popularity, and no fewer than 66 courses have been arranged for the coming year. Those covering foundry and engineering subjects and of potential interest to readers are listed in what follows:—

Apprentices' Courses (March 27; April 20; May 18; August 25, 26, and 27).
This one-day course is intended to introduce apprentices to the importance and principles of accident prevention. (Course fee, £1.)

Crane Driving and Slinging Courses (January 13; March 26; May 26; September 22, and November 17).
A one-day course in which the lectures and demonstrations will be on strictly practical lines. Although primarily designed for drivers and slingers, it will be of value to foremen, millwrights, safety officers and engineers. (Fee, £2 10s.)

Manual Lifting and Handling Courses (February 17; May 13; June 12; September 15, and November 20).
A one-day course arranged to cover correct methods in manual lifting and handling in industry. (Fee, £2 10s.)

Electrical Course (January 20 and 21; June 10 and 11; November 24 and 25).
A practical course for works' electricians and others engaged in electrical installation and maintenance work in connection with factory equipment. (Fee, £4 10s.)

Foremen and Supervisors' Course (January 22 and 23; March 18 and 19; June 16 and 17; October 29 and 30).
This course is intended to draw the attention of foremen and supervisors to their responsibilities for safety and to help them formulate accident-prevention programmes in their organizations. It is intended for potential, as well as existing, supervisors. (Fee, £4 10s.)

Industrial-truck, Fork-lift Truck and Other Operators (February 24 and 25; July 15 and 16; September 23 and 24).
Essentially a practical course, using the latest materials-handling equipment, loaned by various manufacturers. The lectures cover most material-handling problems, using equipment ranging from pedestrian-controlled equipment to the heaviest trucks. The course is aimed to help operators who have already had driving training, but who require further instruction in the safe handling of their vehicles. It is of interest also to chargehands, foremen and safety officers. (Fee, £4 10s.)

Lifting Machines (Use and Maintenance) Course (April 14 and 15; October 1 and 2).
With the increasing use of mechanized handling of materials, this course has been arranged for those people such as engineers, foremen and safety officers, who are responsible for both using and maintaining lifting machines of all descriptions. (Fee, £4 10s.)

Maintenance Workers' Course (March 10; June 18; October 14).
The special risks of maintenance work, including the hazards involved in electrical work, building repairs and plant installation, are dealt with. Plant layout is to be included. This is intended for maintenance engineers, millwrights and plant engineers. (Fee, £2 10s.)

Planning and Layout (Safety Aspects) Course (April 16 and 17; September 10 and 11; November 18 and 19).
This course is intended to interest junior executives concerned with plant design, materials handling, ventilation, effluent disposal and the like. (Fee, £4 10s.)

Power-press Course (February 20 and 21; March 20 and 21; April 24 and 25; May 29 and 30; June 26 and 27; September 25 and 26; October 23 and 24; November 27 and 28; December 18 and 19).
This course is intended for power-press toolsetters and similar personnel. It includes lectures and demonstrations on numerous types of presses and types of guards. The Draft Regulations for power-press operation require toolsetters to have received training. Note: The course in March is to be held specially for safety officers and supervisors and it will be varied to suit their special needs. (Fee, £4 10s.)

Safety Officers' Course (July 7; November 26; December 17).
A one-day course for executives, personnel officers, foremen and others, whose duties include the overseeing of accident prevention in their works. The causes of accidents, organization of safety methods, the legal obligations, and "training on the job" will be dealt with. (Fee, £2 10s.)

General Arrangements

The objective of the courses described is not to teach persons how to do their job, but how to do it *safely*. Brief details only are given above, but more information, with details of the subjects dealt with at a particular course, may be obtained on application to the manager (see below). In addition, specialist courses (*e.g.* for industrial nurses, factory inspectors, etc.), sponsored by other bodies will be welcomed, and those interested in this aspect are invited to seek information from the secretary of the Group (Mr. W. G. Appleyard). Moreover, any industry or firm wishing to use the premises for the purposes of instruction is invited to do so and arrangements will be made for the full co-operation of the staff.

Visitors are welcome at any time, but advance notice is desirable so that arrangements may be made for the appropriate course director or other official of the Group to be in attendance. In each of the courses, experts are drawn from the field concerned, and as far as possible, are given a practical basis.

If required, simple accommodation at a local hotel can be arranged for those taking courses. This includes dinner, bed and breakfast; other meals are provided at the Centre and are included in the course fees. A full-time manager is now in charge of the Centre and details of the courses may be obtained on application to 22, Summer Road, Acocks Green, Birmingham.

Mond Nickel Fellowships

Mond Nickel Fellowships Committee announced recently the award of a fellowship for 1958 to the following applicants:—Mr. G. H. Longworth (Lancashire Steel Manufacturing Company, Limited), to study the manufacture of plain-carbon and alloy-steels for rod and wire products, in the United Kingdom, on the Continent, and in the United States. Mr. J. C. Morrison (Carron Company), to study melting, moulding and heat-treatment of alloy cast-irons, quality control of metal and sand plants in modern foundries, and new developments in related metallurgical processes; and Mr. T. Tait (Colvilles, Limited), to study the technical and economic factors involved in the use of oxygen in steel industries in the United Kingdom, on the Continent, and in the USA and Canada.

The Committee now invites applications for fellowships of an approximate value of £900 to £1,200 for 1959. These will be awarded to selected candidates of British nationality with degree or equivalent qualifications to enable them to obtain wider experience and additional training in industrial establishments, at home or abroad, to make them more suitable for future employment in senior technical and administrative positions in British metallurgical industries. Each fellowship will cover one full working year. Applicants will be required to state details of the programme they wish to carry out, and completed application forms are required by June 1, 1959. Further details and forms of application are available from the secretary, Mond Nickel Fellowships Committee, 4, Grosvenor Gardens, London, S.W.1.

Vitreous Enamel Advisory Service

The Vitreous Enamel Development Council announce that their enamel advisory service—a free information service for housewives, merchants, and industrialists—has now been extended to the Midlands, Scotland and Wales. The addresses of the regional advisory services offices are Cornwall Road, Smethwick, Staffs ('phone Smethwick 1915); Gowan Avenue, Falkirk (Falkirk 445), and Hurman Street, Cardiff (Cardiff 33644).

PHOSPHOR BRONZE COMPANY, LIMITED—Mr. Eric Walker has been appointed managing director of the company, which is a member of the Birfield group, in succession to Mr. A. N. Wormleighton. Mr. Walker will be assisted by Mr. Philip Broadbent as works manager, Mr. Jack Kitchen as sales manager, and Mr. Gordon Swinyard as chief metallurgist.

News in Brief

THE TITLE of the Birmingham Exchange and Engineering Centre has been changed to the Engineering Centre as over 60 per cent. of the exhibitors are from areas other than Birmingham.

THE ANNUAL CONVENTION of the Australian branch (Victoria) of the Institute of British Foundrymen is being staged from Tuesday to Friday this week, with the annual dinner and ladies' night as the final function.

CHAMBERLAIN INDUSTRIES, LIMITED, of Staffa Works, Staffa Road, Leyton, E.10, announces that it has been appointed sole distributor throughout the United Kingdom for the Rival Swiss-made conduit bending machine.

THE FILE TRADE ASSOCIATION has cut prices by ten per cent. as a move to combat foreign competition and competition from firms outside the Association. There are some 40 makers or suppliers of files, mainly in Sheffield, who have reduced their prices accordingly.

WORKERS IN THE IRONFOUNDRY DIVISION of Guest Keen & Nettlefolds, Limited, Cwmbran, Monmouthshire, have begun a four-day week, and about 250 employees are affected by what is believed to be a seasonal recession. The section of the works affected produces railway-chairs and base-plates.

AT AN "OPEN DAY" at the St. John's Works of Hepworth & Grandage, Limited, engineers, in Wakefield Road, Bradford, on November 8, some 200 parents and relatives of apprentices were welcomed by Mr. G. Collin Hepworth, chairman and managing director. Throughout the afternoon the works were open for inspection, and then followed an apprentices' prize presentation.

IN SPITE OF A TENDENCY to trade recession there have generally been sufficient vacancies for young people leaving school in all categories except craft apprenticeships, says the annual report of the Coseley Youth Employment Committee. In the craft apprenticeship category, however, foundry vacancies remained unfilled owing to a general reluctance to recognize moulding as a skilled trade, it is stated.

AN ORDER FROM Titania A/S, Norway, for the supply of a special type Class H.18 rotary dryer, 104 in. by 70 ft. long, has been received by Head Wrightson Stockton Forge, Limited, a subsidiary of Head Wrightson & Company, Limited. The dryer is to be used for the drying of ilmenite in a new titanium ore concentrates plant at Telnes, south-west Norway, which is being financed on an international basis.

SENATOR SPOONER, Australian Minister for National Development, announced recently the proving of substantial iron-ore deposits in the Savage River area of N.W. Tasmania. The discovery, he said, was of great importance to the Australian iron and steel industry and the national economy. Drilling results suggested that the field contained 100,000,000 tons of low-grade ore which it was hoped to improve by simple ore-dressing processes.

LLOYDS (BURTON), LIMITED, iron and steel founders, who recently placed 200 men on short time, are now back on full-time working. Mr. G. Aston, company secretary, said this week that it seemed likely that they would be able to maintain full-time working at least to Christmas. He could not say whether it was permanent, but he was hoping it betokened some trend. By Christmas it was hoped the industrial "climate" would have improved.

THE US DEPARTMENT OF COMMERCE has announced that controls on more than 250 products exported to all countries, with the exception of the Sino-Soviet block, Hongkong, and Macao, were removed on November 10. The products affected include many rubber, paper, petroleum, glass, abrasive, and iron and steel goods; ores and metals; electrical, industrial and construction machinery; machine tools; motor vehicles; railway equipment; chemicals, and scientific instruments.

ALDERMAN A. G. B. OWEN, head of the Rubery Owen group, was elected president of the newly-formed South East Staffordshire Productivity Association at the inaugural meeting at Wednesbury on November 10. Chairman of the association is Mr. R. H. Minns, with Mr. J. E. Hockley, secretary, and Mr. G. Bradburn treasurer. The new Association hopes to attract membership from firms in the Wednesbury, Darlaston, Willenhall, Cannock, Aldridge, West Bromwich and Walsall areas.

SHEFFIELD WESTON PARK MUSEUM is to house the Unesco scientific exhibition, "The Earth as a Planet" for a month next February. The 30-ft. high French rocket, the Veronique, is to be set up in the forecourt, and there will be more than 100 pieces of scientific apparatus on show. The seven sections of the exhibition are of solar activity, the earth as a magnet, the upper atmosphere and transmission of radio-electric waves, lower atmosphere and meteorology, auroral phenomena, cosmic rays, and I.G.Y. research.

IT WAS IN 1709 that Abraham Darby first used coke in the manufacture of iron at Coalbrookdale, and to celebrate the 250th anniversary of this event a commemorative programme is being planned for September, 1959. Shropshire County Council has been asked to join in sponsoring the celebrations, and it is reported that the Coalbrookdale Company, Limited, which now forms part of Allied Ironfounders, Limited, is to spend a considerable sum of money on the preservation of the old furnace and the surrounding site.

EIGHT EMPLOYEES OF STANTON IRONWORKS COMPANY, LIMITED, received gold awards from Prince Philip at Buckingham Palace on November 18, under the Duke's award scheme. The winners, and other employees who have gained bronze and silver awards, attended a ceremony at Stanton and were told by Sir Frederick Scopes, chairman, "The company is always glad to provide whatever facilities we can and we are delighted when we find such good use is made of them." Eight of the 49 gold awards were gained by the Stanton company—the most by any single company taking part in the scheme.

THE TENTH ANNUAL DINNER of the Foxboro-Yoxall 10-year Service Club was recently held at the Wimbledon Hill Hotel. Just over 100 members of the staff were present for the reception and dinner. Afterwards some 20 new members were presented with their club emblems by Mr. Corodon S. Fuller, vice-president of the Foxboro Company of America, who had flown over for the occasion. Mr. L. S. Yoxall, managing director of the UK firm, spoke of the successful inauguration, in May of this year, of the company's new factory at Redhill and outlined the plans for the further developments that remain to be completed.

AN INTERNATIONAL SCIENTIFIC RESEARCH EXHIBITION described as a new type of exhibition—is being organized to take place at Olympia, London, in October next year. Under the four main themes, "health and food; materials; transport and communication; and

(*Continued on page* 642)

Company News

GUEST, KEEN & NETTLEFOLDS, LIMITED—As forecast, a 4 per cent. interim dividend on the ordinary capital, increased by a 30 per cent. scrip issue to £39,492,069, is declared on account of the 53 weeks ending January 3,

W. T. HENLEY'S TELEGRAPH WORKS COMPANY, LIMITED—The offer by Associated Electrical Industries, Limited, for the share capital of the company has been accepted by holders of over 90 per cent. of both preference and ordinary and the offer becomes unconditional.

HALE & HALE (TIPTON), LIMITED, malleable iron founders, of Tipton (Staffs)—Although group trading profits for the year ended August 4, 1958, show a reduction on last year of only £2,189, the ordinary dividend is being cut by 10 per cent. Final dividend is to be 10 (17½) per cent., making 15 (25) per cent. Group trading profits were returned at £69,960 (£72,149) and net profits amounted to £18,884 (£26,701).

SPENCER (MELKSHAM), LIMITED, manufacturers of elevating, conveying, and conditioning plant, of Melksham (Wilts)—The company is maintaining 12½ per cent. for the year to September 30, 1958, and has declared a 2½ per cent. interim for the current year, payable with the 1957-58 dividend. Profit is £284,929 (£268,426), less tax of £155,510 (£146,878), leaving £129,419 (£121,548)—the 1957 figures are adjusted to correct tax underprovision of £5,100.

JOSEPH LUCAS (INDUSTRIES), LIMITED—The dividend is maintained at 7½ per cent. with a 5 per cent. final for the year to July 31, 1958. A special interim of 2½ per cent. is declared in respect of 1958-59, the normal 1958-59 interim being considered as usual next March. In addition to the 7½ per cent. dividend for 1956-57, holders received 1½ per cent., tax free, out of the surplus arising from the sale of investments in industrial companies outside the group. After tax and including exceptional items, the group net profit of £2,241,956 compares with £1,668,275.

WILMOT-BREEDEN (HOLDINGS), LIMITED, holding company for manufacturers of car and domestic appliance accessories, of Birmingham—Preliminary to the new capital issue, proposals for the simplification of the capital structure have been passed. At the first extra-ordinary meeting, the reserve of unissued capital was increased to 8,000,000 ordinary shares, with a nominal value of £2,000,000, none of which is to be issued for cash without prior reference to shareholders. Nor will an issue be made in exchange for shares in other businesses in such a manner that control would pass to the vendors of those businesses.

BIRMINGHAM SMALL ARMS COMPANY, LIMITED—The board has decided that the time has come for the distribution of a larger share of profits and it is increasing the final distribution by 1 per cent. to 8 per cent. to make 11 per cent. for the year to July 31, 1958. Last year the dividend was raised by 2 per cent. to 10 per cent. with a final payment of 7 per cent., restoring the 2 per cent. cut made in respect of 1955-56. The directors state that the short-term prospects, due mainly to the recession in the machine-tool and steel industries, are less favourable than they were 12 months ago. Consolidated trading profits are £2,261,707 (£2,202,666), and the net profit is £1,056,726 (£1,419,966).

Mr. D. A. PEASE has been appointed an additional director of the Heenan group of companies.

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Never say die when it comes to casting,
DIE SLICK'S a trick that's everlasting,
Here's a slick will make you master,
Casting cleaner, slicker, faster.

When you're in deep water friend,
And you feel this is the end.
When your cherished castings fail,
Holler for the DIE SLICK pail.

Foremen know its famous touch,
Just a dab or two, not much
Will transform a scene so tragic,
Successfully, as though by magic.

For aluminium, brass or zinc,
DIE SLICK is the missing link.
A choice of grades all made to measure,
Casting then becomes a pleasure.

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News in Brief

(*Continued from page* 640)

power and industry," there will be demonstrated the influence scientific development plays in the daily round, and the promise scientific discovery and research holds for the future. The scientific director is Mr. Arthur J. Garratt and details are available from International Scientific and Research Exhibitions, Limited, Oswaldestre House, 34-35, Norfolk Street, London, W.C.2.

NO INCREASE in the price of electricity is foreseen, said Mr. Dennis Bellamy, chairman of the Yorkshire Electricity Board, at a meeting of the Yorkshire Electricity Consultative Council on November 3. For those using electricity for longer hours, he continued, there was every prospect of getting current much cheaper, on the other hand, a revision of tariffs within a short time might mean a higher price for those with comparatively small use in relation to the demand they made. When nuclear power stations came into being, he said, there would be an increase in the initial capital costs, but the operational costs of these power stations would be correspondingly smaller.

IF THE BRITISH INDUSTRIES FAIR had been held every third year instead of annually, it would still have been one of the greatest exhibitions in the world to-day, said Mr. K. F. Smith, director of Herbert Daniels Exhibitions, Limited, when he addressed the Birmingham branch of the Incorporated Sales Managers' Association on November 10. The future of British exhibitions, he said, might very well lie overseas. A suggestion had been put to the Board of Trade three years ago for a travelling exhibition to tour continental capitals. The proposal was still under consideration. (Herbert Daniels Exhibitions, Limited, are organizing the UK foundry exhibition to be held in Birmingham, next May.)

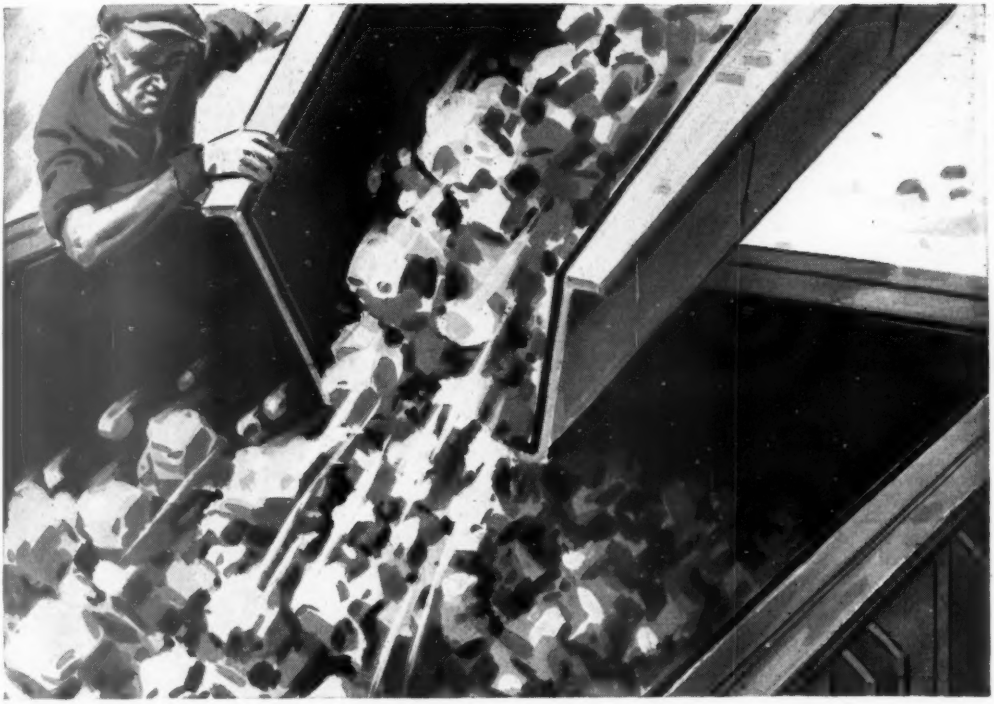
LAMBERT BROTHERS (WALSALL) LIMITED, has recently acquired the whole of the share capital of the old-established firm of Ansell, Jones & Company, Limited, Naval Works, Walstead Road, Walsall. Ansell, Jones & Company, Limited, are makers of marine equipment such as pulley blocks, winches, shackles, etc., for the Admiralty, the Merchant Service, shipbuilders and the yacht and small-boat-building trade. While a certain amount of minor integration between the two companies will take place, it is intended that Ansell, Jones shall continue to trade as a separate entity. It will however be strengthened by having the technical and manufacturing resources of Lambert Brothers available to it. A new board of directors has been elected consisting of:—C. S. L. Incledon, B.SC., A.M.I.MECH.E. (managing); G. H. Incledon; A. L. Peavot, A.A.C.C.A., and T. I. C. McKenzie, M.A., A.M.I.MECH.E.

SIR RONALD NESBITT-HAWES, educational adviser to the English Electric Company, Limited, addressed the second annual conference of the West Yorkshire Federation of the National Association of Schoolmasters at Leeds. He said that a boy who had been a person of some consequence at school would find himself to be a person of little consequence in his first job, and this was a major revolution in his life. Boys entering industry found the discipline much stricter, also they had to concentrate on one type of job as contrasted with a number of subjects at school. Many failures were due to the boys not being prepared for a change in their educational system. In these days, he said, a good concern placed its young men into a training centre, where they could be supervised by experienced instructors who not only taught them but were interested in them and helped them solve their transitional problems.

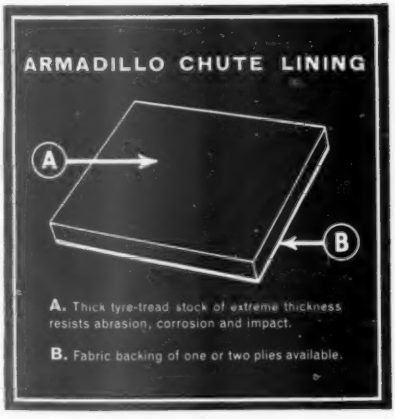
ADDRESSING SOME 100 EXECUTIVES at a meeting in Birmingham, on November 5, arranged by the Midland branch of the National Union of Manufacturers, Mr. Russell J. Clark, principal of the economic intelligence department of the Westminster Bank, said that about 40 per cent. of the total of about £2,000 million which the banks were lending to all classes of borrowers was absorbed by loans to manufacturing industry. The purpose of the meeting was to study the problems met by the small manufacture in the financing of short- and long-term development. Mr. Clark said no manufacturer who had a sound proposition need hesitate to approach his bank for help, and he urged manufacturers to give bankers more encouragement to visit factories. Advice on medium- and long-term financial problems was given by Mr. E. V. B. Ralph of the Industrial and Commercial Finance Corporation and the part of the accountant was outlined by Mr. Christopher Bostock.

SPEAKING AT THE ANNUAL PRIZE DISTRIBUTION at Stanton Ironworks Company, Limited, Mr. W. S. Matthews, training officer said that the firm had now decided to permit students to conclude their training with full-time study. It had become evident, he said, that the students capable of attaining the higher technological qualifications could not cover their wide syllabus of studies by the normal day-release courses, and with this in mind, it was found possible, with the willing co-operation of their departmental managers, to release these students for a final period of full-time study. The chairman of the company, Sir Frederick Scopes, who presided, said that a lot was heard nowadays of technical and technological education. The fact that this was the fortieth function of its kind showed that all this kind of thing was not something new at Stanton. They had a tradition and that tradition was being handed on almost from generation to generation. Sir Frederick congratulated 19-year-old apprentice moulder, Denis Perkins, who, with two other apprentices, will comprise the team to represent Great Britain in the European Foundry Apprentice Competition in Paris later this month.

THE UNITED STATES AMBASSADOR, Mr. John Hay Whitney, recently visited Sheffield for the second time in two years. On November 3, he visited the works of Firth Brown Tools, Limited, and on the following day, those of the English Steel Corporation, Limited. At Firth Brown's he was accompanied by Mr. Eric Mensforth, managing director of the company, together with other directors and representatives of the Institute of Directors. That evening he attended the annual dinner of the Institute of Directors, and in his speech he said that he was replying to two questions put to him when he spoke at Coventry eight months ago. The questions were how far the trade recession in America would go before conditions improved, and when would recovery set in? He said that the American economy had now recovered and was expanding, and added that the recession had not hampered British exports to the States. Speaking of the economic systems of Russia and the western world, he said that the Soviet Union had the advantage of absolute power and freedom from the normal restraints of a free-enterprise system. They could sell raw materials at less than world prices if they wished, and buy production of under-developed countries at subsidy prices. Mr. Whitney said of his tour "I have long heard Sheffield called the Pittsburgh of the United Kingdom, but in my own view, I think we at home might well start calling Pittsburgh the Sheffield of the United States."



DEFEAT ABRASION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A. Thick tyre-tread stock of extreme thickness resists abrasion, corrosion and impact.
B. Fabric backing of one or two plies available.

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HERE'S A LINING material that will even outlast heavy gauge steel, Goodyear Armadillo Chute Lining. Built from tough rubber compounds, which may be backed by fabric, it resists crushing, abrasion, acids, corrosion and heat. Its uses are limitless – it gives longer life to chutes handling abrasive materials, is used as lagging for driving drums, protects the insides of truck bodies, guards the walls of shot-blast chambers against wear. Available in a wide range of sheet sizes and thicknesses, it can be easily fabricated. Armadillo Chute Lining has important applications in *your* industry. Ask for details from The Goodyear Tyre & Rubber Company (G.B.) Limited, Industrial Rubber Products Department, Wolverhampton.

GOODYEAR

INDUSTRIAL RUBBER PRODUCTS

CONVEYOR BELTING • V-BELTS • TRANSMISSION BELTING • HOSE

Personal

Mr. DONALD C. ALTMAN has been appointed assistant managing director of Allis-Chalmers Great Britain, Limited.

Mr. J. MURPHY formerly a director of Moorhouse & Cope, Limited, brass founders, Grosvenor Street, Stalybridge, has now left the firm. He is emigrating to Canada.

Mr. B. N. REAVELL, B.SC., deputy chairman and joint managing director of the Kestner Evaporator & Engineering Company, Limited, recently left the UK for a brief Australian tour.

Mr. I. HEY, M.SC., M.I.MECH.E., chairman of directors of Henry Simon, Limited, presented the prizes at the annual speech day of Marple Willows Secondary School on November 10.

Mr. R. YEOMAN, general manager for the Hodgkinson group of foundries, has been appointed to the board of A. B. Scorer, Limited, a subsidiary company of James Hodgkinson (Salford), Limited.

Mr. ROBERT R. BODDY, who retired 13 years ago as foreman in the foundry of Smith & Paget, Limited, Keighley, where he had been employed for 38 years, celebrated his diamond wedding anniversary on November 15.

British Valve Manufacturers' Association announces the re-election of Mr. J. W. PLOWMAN of Dewrance & Company, Limited, as chairman, and of Mr. N. P. NEWMAN, Newman, Hender & Company, Limited, as vice-chairman.

British Oxygen Company, Limited, announce that Mr. R. A. MILLAR CRAIG, B.SC., has been appointed general works manager for the new factory which is now under construction by Carbide Industries, Limited, at Maydown, Londonderry.

Mr. W. R. STAINTON, has been appointed head of the engineering department of Gainsborough County Technical College. He succeeds Mr. W. FITZGERALD, who has taken up a teaching appointment with the New Zealand Shipping Company.

Mr. W. H. ATHERTON, of Derby, former engineering director of Ley's Malleable Castings, Limited, Derby, and technical director and general manager of the Ewart Chainbelt Company, Limited, Derby, recently celebrated his 91st. birthday.

Mr. P. R. Allen, chairman of the Trent Engineering Company, Limited, Nottingham, presented a gold watch to 71-year-old Mr. HARRY GARNER, a turner, in recognition of his 40 years' service with the firm, on November 12. Mr. Garner joined the firm two months after its formation.

Mr. F. N. SUTHERLAND, general manager of Marconi's Wireless Telegraph Company, Limited, has been elected to the board and appointed managing director. He has also been elected a director of Marconi Instruments, Limited. Mr. PAUL DE LASZLO, who has been associated with the Marconi group for a number of years, has also been elected to the boards of both companies.

Mr. PERCY SMITH, superintendent of the patternmaking department of Sentinel (Shrewsbury), Limited, for the past 34 years, has retired. He started his career with C. & W. Walker, Limited, at Donnington, later moving to the Lilleshall Company, Limited, and then to Joseph Sankey & Sons, Limited. He was in business on his own as a master patternmaker for a number of years before joining Sentinel.

Tecalemit, Limited, of Plymouth, announce that Mr. B. E. RICHMOND has relinquished his position as general factory manager to enable him to concentrate his activities as managing director Foamite, Limited, fire-protection engineers, London, a member of the Tecalemit group. His successor is Mr. J. E. DRINKWATER. Another appointment is that of Mr. J. E. JACKSON, who has been appointed chief engineer.

Philips Electrical, Limited, announce the following three appointments to take effect from January 1, 1959. Mr. HECTOR THORNE, at present general regional manager, south-east region, to be a personal assistant to the managing director, responsible for market development. Mr. W. F. CASSIDY, at present regional manager, Midlands region, to be general regional manager, south-east region, and Mr. D. E. BEARD, at present branch manager, Bristol, to be regional manager, Midlands region.

Brown & Polson, Limited, announce that Mr. J. B. BECK has been appointed chairman of the board of directors. As part of his responsibilities as a director of European operations for Corn Products Company, the American affiliate, Mr. Beck will continue to be closely associated with the Brown & Polson group. Mr. S. R. BROWN succeeds Mr. Beck as managing director and will be responsible for the management of the group. Mr. J. H. REID becomes deputy managing director, in which capacity he also remains responsible for the finance division.

Mr. JOHN RANNIE shipyard director of John Brown & Company (Clydebank), Limited, has been appointed president of the Clyde Shipbuilders Association in succession to Mr. W. H. MCLAY, director and general manager of Barclay Curle & Company, Limited, Glasgow. Mr. W. B. JOHNSTONE, a director of Alex. Stephen & Sons, Limited, Glasgow, has been reappointed vice-president, and Mr. J. B. CUNNINGHAME, secretary of Barclay Curle & Company, treasurer. Mr. G. MORRISON, managing director of the Greenock Dockyard Company, Limited, has also been appointed a vice-president.

Mr. ROBERT W. JOHNSON, chairman and managing director of Cammell Laird & Company (Shipbuilders and Engineers), Limited, Birkenhead, was elected president of the Shipbuilding Employers' Federation at the annual general meeting of the central board in Edinburgh on November 14. He succeeds Mr. GEORGE C. PARKER, managing director of the Caledon Shipbuilding & Engineering Company, Limited, Dundee. Mr. G. HAROLD R. TOWERS, chairman and managing director of John Readhead & Sons, Limited, South Shields became senior vice-president. Mr. JOHN RANNIE, shipyard director of John Brown & Company (Clydebank), Limited, and Mr. R. CYRIL THOMPSON, chairman of Joseph L. Thompson & Sons, Limited, Sunderland, were appointed vice-presidents. Mr. L. REDSHAW, a director and shipbuilding general manager of Vickers-Armstrong (Shipbuilders), Limited, of Barrow and Newcastle, was elected chairman of the conference and works board, and Mr. ALEC H. WEEKS, general manager of the Penarth Pontoon, Slipway & Shiprepairing Company, Limited, Penarth Dock, Cardiff, was elected vice-chairman.

Foundry Trades Equipment and Supplies Association

The result of the second ballot for the election of Members of Council of the Foundry Trades Equipment and Supplies Association, was that the three retiring Members were re-elected together with Mr. R. A. Miller (Foundry Services, Limited) and Mr. R. Sutcliffe (Fordath Engineering Company, Limited).

Electrical Aids in Industry *Data Sheet* **No. 4**

Resistance Heating – 1

In this form of heating, the heat is produced by passing an electric current through a high resistance conductor which is termed the "heating element".

The heat is transferred from the heating element to the work by convection, radiation or conduction or by a combination of any, or all, of these. When it is a question of radiation or convection, the element can be a bare wire or strip of suitable material, provided it is adequately supported on electrical insulation capable of withstanding the temperature.

When there is to be contact between the work and the element, heat being transferred to the work by conduction, the wire or strip must be surrounded by suitable insulating material and enclosed in a protective sheath.

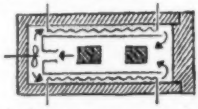
In the majority of cases, the wire or strip forming the heating element is made of a nickel-chromium alloy which has a high electrical resistance and can be safely used in air at temperatures of up to 1050°C., or in a suitable atmosphere, of up to 1150°C. Other element materials are available for use at higher temperatures.

Electric resistance heating may profitably be put to many diverse uses; two of these are described briefly below, others will be listed in a subsequent data sheet.

Furnace Heating

Electric resistance furnaces can be divided into two main categories, batch type and continuous. In most cases, the heating elements are of nickel-chromium alloy, for furnace temperatures up to around 1050°C., but higher temperatures, up to nearly 3000°C., can be obtained by using other metals or alloys, or in some cases non-metallic elements. A protective atmosphere is desirable to prolong the life of some of these higher-temperature elements. For all temperatures, electric resistance furnaces can be constructed so that the heating process takes place in a controlled atmosphere if this is dictated by the composition or heat requirements of the work charge. In some furnaces, fans are used to circulate the air or special atmosphere over the charge, thereby giving increased heating rates and a uniform temperature over the whole charge.

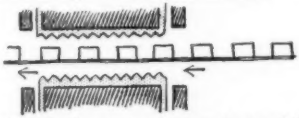
Automatic temperature control and programme control of the heating process are readily effected.



Electric furnaces are extensively used in industry, for example in the general heat treatment of metals, in the glass and ceramics industries, for brazing and sintering, and for many other applications requiring temperatures above 500°C.

Oven Heating

There are two basic forms of heat transfer used in electric resistance ovens; convection and radiation. The latter is dealt with in a separate data sheet under the heading "Infra-Red Heating".



Convection ovens may again be of the batch or continuous type. In either case, the charge is heated mainly by the movement of hot air, which is sometimes assisted, as in furnaces, by fans to give a rapid and uniform temperature rise. Ovens are normally designed for temperatures of up to about 500°C., and the heating elements are invariably of nickel-chromium or nickel-chromium-iron alloy.

Ventilation, when required, can be provided and regulated entirely to suit the heating process. Temperatures and times are readily controlled. A vacuum can be maintained in suitably designed ovens to assist in the extraction of moisture and solvent.

Convection ovens are extensively used for drying, baking and stoving operations, and for a host of other processes requiring a low or medium temperature.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, W.C.2.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available—"Induction and Dielectric Heating" is an example; "Resistance Heating" is another.

E.D.A. also have available on free loan a series of films on the industrial use of electricity. Ask for a catalogue.

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Raw Material Markets

Iron and Steel

Business at the ironfoundries continues to fluctuate. Regular schedules for requirements of high-duty and heavy castings are received by the engineering and speciality foundries, enabling them to achieve reasonably good outputs, though in most instances not at capacity levels. The motor-car industry maintains a fairly good demand, but some of the foundries catering for them report a recent further drop in demands which has affected outputs adversely. This trade, however, is optimistic of the future, and expects demands for castings to increase.

The machine-tool trade has not yet picked up to its former level of business, while demands from the heavy engineering industry and other trades are still below normal. Overall demands for castings from the engineering and speciality foundries, however, including the requirements of home trades, collieries, steelworks, etc., keep these foundries employed on a scale comparatively much more favourable than in other sections of the industry. Only spasmodic demands for castings are being received by the light, jobbing, and textile foundries, many of which are working much below capacity.

In the light-castings trade there are some slight signs of improvement following on the increased trade for domestic equipment, but a much bigger demand is needed to bring an overall improvement. Generally there is little forward buying of castings and, due to the uncertainty of trade and prices, consumers are unwilling to depart from their practice of buying for present needs only. There are reports of undercutting of scheduled prices of low-phosphorus irons in an endeavour to secure business.

The recent increase of 7½ per cent. on freight charges on certain raw materials delivered to the foundries is causing some confusion, as apparently the trade received no official notice of the intention of the British Transport Commission to increase this charge.

Raw materials are plentiful for the ironfoundries. Pig-iron in all grades can be obtained without difficulty; indeed, outputs at the furnaces are still much in excess of demands and stocks continue to rise. The foundries themselves are keeping stocks at a minimum and they are well provided with most grades of scrap, although heavy cast-iron and machinery scrap is not so easily obtainable as other grades. Coke deliveries are satisfactory, and ganister, limestone, and firebricks are readily obtainable.

There is little improvement in business at the rerollers and most of them continue to work below capacity. Home demands for small bars and light sections are only moderate and for the export market UK prices, apart from special quality steels, are not competitive with those of producers abroad. Plentiful supplies of steel semis can be obtained from home steelworks which could increase appreciably present deliveries if the demand warranted.

Non-ferrous Metals

The US Government's decision to relax controls on the export of copper to all countries with the exception of the Soviet Union, Hongkong, and Macao made itself felt in no uncertain terms on the copper price in London last week. Indeed, last week the price of copper in London fell by more than £21 and the backwardation closed up to under £4 a ton. In some ways, the precipitous decline in the copper quotation is understandable. The fear of an acute shortage of metal developing in this country and on the Continent because of the various strikes raised the question as to what price the US producers would let copper flow across the Atlantic to meet demand. The surprise has been that the US producers have kept their price at 29 cents a pound—the lowest in the world—and the custom smelters have not raised theirs beyond 30 cents a pound. Since both these prices are below the US export price and were well below the London quotation, the UK price dropped to bring it into line with US suppliers. World stocks of refined copper held by producers, which topped 500,000 tons at the end of April last, dropped 107,000 tons during October and now stand at 269,000 tons.

The market in New York is strong and in London firm. Demand from the Continent and perhaps particularly from West Germany has been a steadying influence. Stocks in LME warehouses at the end of last week rose for the first time since the middle of last July and at the end of last week stood at 6,096 tons, a rise of 117 tons.

To some extent tin, lead, and zinc all fell in sympathy with copper last week. They have also improved this week. Tin has been a steady, if quieter, market than in recent weeks. Demand in the East, from the Continent, and on the other side of the Atlantic is very steady, although trading in London is quiet. A slightly bearish influence is the expected arrival in the United Kingdom shortly of some Russian metal. At the end of last week tin stocks in London totalled 17,282 tons. In the US the price is around $1 a pound. The outlook for tin is good. It has been included in the list of strategic materials the US can accept in exchange for surplus farm products and it is believed in some quarters that the barter programme may well last for two years.

The inclusion of lead on the barter programme list pushed up the price of lead in London sharply and if demand can be maintained at a reasonably high level the price will continue to rise as stocks on this side of the Atlantic are not high. In America the price is firm at 13 cents a pound and, with the consistently good progress being made by the US automobile industry, the quotation could very well go higher in the not too distant future.

Zinc, like lead and tin, is also being included in the barter programme, and with supplies tightening in the UK, the LME spot price for zinc has once more overtaken the price for lead. In the US, the East St. Louis spot price is firm at 11½ cents a pound. The US steel industry continues to expand its production and, with good reports emanating from Detroit, the US price could easily go higher when stocks have been whittled down to more manageable levels.

A NEW SAFETY TRAINING CENTRE for foremen and others in the building and civil engineering industry was opened yesterday at the Government Training Centre, Enfield. The opening ceremony was performed by the Hon. Richard Wood, M.P., Parliamentary Secretary to the Ministry of Labour and National Service. The establishment of this Training Centre marks a further development in the co-operation between the Government and Industry in a drive to cut down the numbers of accidents on building and civil engineering sites. Last year more than 16,000 accidents were reported in these industries including 185 fatalities out of a total labour force of about one and a quarter millions.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(*Delivered unless otherwise stated*)

November 19, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.: North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.: N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered*)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £44 0s. 0d. to £44 10s. 0d., scale 15s. 0d. per unit; 75 per cent. Si, £58 0s. 0d. to £62 10s. 0d., scale 16s. 0d. to 17s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 7s. 11d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 10s. 11d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £83 10s. 0d. to £87 0s. 0d., basis 60 per cent. Cr, scale 30s. 0d. to 30s. 6d., per unit; over 6 per cent. C, £79 10s. 0d. to £85 0s. 0d., basis 60 per cent. Cr, scale 30s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8½d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent. C* 1s. 9¾d. to 2s. 0¾d. per lb. Cr; 0.06 per cent. C,* 1s. 10d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £265 0s. 0d.; 96/98 per cent., £295 0s. 0d.

Ferro-columbium.—65/72 per cent., Nb + Ta, 19s. 9d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £73 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., £32 15s. 6d.; tested, 0.08 to 0.33 per cent. C, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), £34 17s. 0d.; silico-manganese, £43 16s. 6d.; free-cutting, £36 14s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E. Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £40 0s. 6d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, £39 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £44 16s. 0d.; black sheets (hand mill), 24g., £58 14s. 6d.; galvanized corrugated sheets, 24g., £66 16s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 11s. 0d.; nickel-chrome-molybdenum, £111 19s. 0d.

NON-FERROUS METALS

Copper.—Cash, £238 10s. 0d. to £238 15s. 0d.; three months, £235 10s. 0d. to £235 15s. 0d.; settlement, £238 15s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 3⅝d. per lb.; rods, 253s. 6d. per cwt. basis; 20 s.w.g., 288s. 6d. per cwt.

Tin.—Cash, £760 0s. 0d. to £760 10s. 0d.; three months, £761 10s. 0d. to £762 0s. 0d.; settlement, £760 10s. 0d.

Lead (Refined Pig).—Second half November, £76 15s. 0d. to £77 0s. 0d.; second half February, £76 15s. 0d. to £77 0s. 0d.

Zinc.—Second half November, £77 0s. 0d. to £77 5s. 0d.; second half February, £74 5s. 0d. to £74 10s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £110 10s. 0d.; rolled zinc (boiler plates), all English destinations, £108 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £94 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10½d. per lb.; sheets to 10 w.g., 200s. 0d. per cwt.; wire, 2s. 8d.; rolled metal, 200s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £151; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £190; HTB2 (38 tons), —; HTB5 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £192; LG3 (86/7/5/2), £203; G1 (88/10/2/½), £264; (88/10/2/1), £249.

Phosphor Bronze.—BS1400, PB1 (AID released), £285 per ton.

Leaded Phosphor Bronze.—BS1400, LPB1 (1060), £218 per ton.

Phosphor Bronze Strip, etc.—Strip, 291s. 0d. per cwt.; wire, 4s. 1½d. per lb.; rods, 3s. 4½d.; tubes, 3s. 4½d.; chill cast bars: solids 3s. 3¾d.; cored 3s. 4¾d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 9¾d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 2¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 1¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £78 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £230; AB2, £238.

* Average 68-70 per cent.

Thos. W. Ward's Prospects

A warning that shareholders must be prepared to face a reduction in profits in the next accounts is given by Mr. H. W. Secker, chairman of Thos. W. Ward, Limited, engineers, iron, steel, and machinery manufacturers and merchants, etc., of Sheffield, in his review accompanying the accounts for the year ended June 30, 1958. For the first six months of the year group profit and turnover were running at a similar level to the same period in the previous year, but in the turn of the year trading conditions began to deteriorate, particularly in the steel industry, and this reduction has persisted.

Mr. Secker refers also to the recession in orders for machine tools and to a sharp deterioration in the scrap-iron and steel and shipbreaking sections of the company's business towards the end of the year.

Future Prospects

Dealing with future prospects, Mr. Secker reports that for the three months ended September 30 there was a material decrease in the volume of business transacted, and although there were signs that the downward curve was flattening out, it was unlikely that a real upward trend would develop for several months and at the earliest not before next spring.

He adds: "I consider it improbable that any recovery that may take place in the latter part of the year will be sufficient to offset the falling away already experienced, and shareholders must therefore be prepared for a reduction in group profits in the next financial accounts. The prediction for the short term does not imply any lack of confidence in the longer term prospects."

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

HUDDERSFIELD, December 8—Supply of any or all of the following for the period of 12 months ending December 31:—Period contract (A) British Standard cast-iron pipes; (B) BS special castings; (C) special castings, and (D) surface boxes. Documents from the Waterworks Engineer, 24, Ramsden Street, Huddersfield.

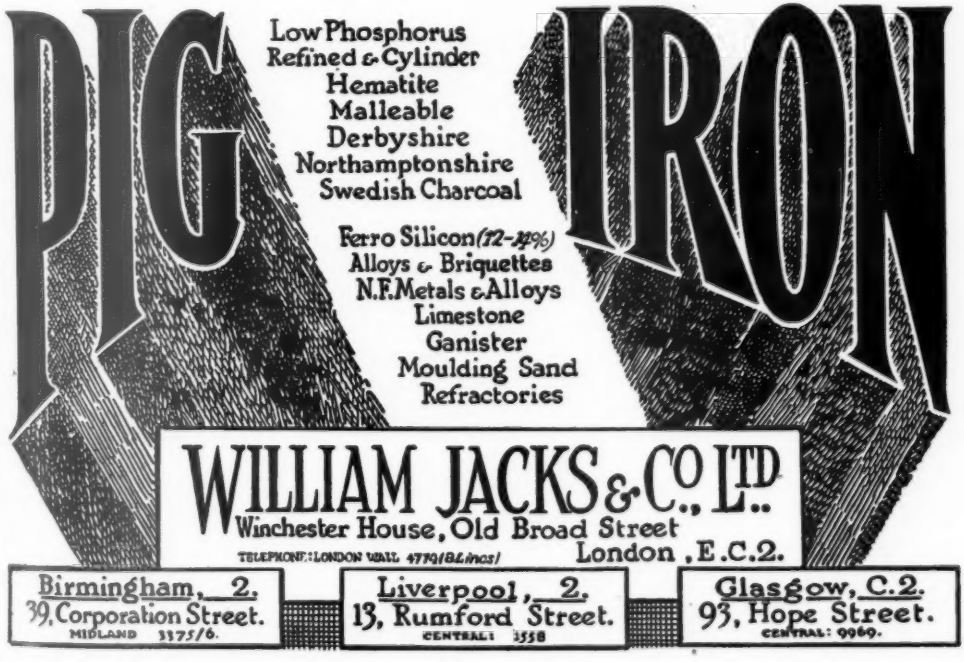
WEST SUSSEX—Requirements of County Council in respect of the year ending March 31, 1960, include iron castings, tender No. 1(e). Applications to be made before November 27; documents from County Surveyor, County Hall, Chichester.

BELFAST, November 28—Supply of iron-pipe castings and cast-iron surface boxes during the year 1959, for City and District Water Commissioners. Documents from Norman Agnew, secretary, Water Office, Belfast.

SUDAN, December 11—Double-headed emery grinder. (ESB/27925/58.)

Recent Wills

GREEN, ARTHUR, of Buxton, formerly of Whittington, Chesterfield, retired ironfounder	£10,806
LORIMER, W. D., a director of the North British Locomotive Company, Limited, Glasgow ...	£33,226
GALE, T. J., for 38 years associated with the Pulsometer Engineering Company, Limited, Reading	£7,070
TWIGG, WILLIAM, managing director of William Twigg (Matlock), Limited, iron and steel merchants and structural engineers	£39,142
JENKS, R. P., late chairman of John Shaw & Sons, Wolverhampton, Limited, holding company for toolmakers, etc.	£91,590
LAMB, JOHN, marine engineer, designer of the first merchant ship powered by gas turbines to cross the Atlantic, director of research and development of the Anglo-Saxon Petroleum Company, Limited	£35,447



CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Fifteen words for 7/6 (minimum charge) and 4d. per word thereafter. Box Number 2/6 extra (including postage of replies). Situations wanted 2d. per word throughout.

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

YOUNG REPRESENTATIVE. Experienced technical sales of all types foundry work, present area Midlands, seeks change. Also experience management and estimating. Box YR328, FOUNDRY TRADE JOURNAL.

FOUNDRY TECHNOLOGIST, Draughtsman, Metallurgist, Estimator, Engineer, and Moulder. Loam, dry and green sand, also CO$_2$. Jobbing and mech. Metals, steel, iron, and non-ferrous. Able to quote from prints for production and costs. Box FT330, FOUNDRY TRADE JOURNAL.

FOUNDRY SUPERINTENDENT desires situation. Steel up to 18 tons. Iron up to 5 tons. Jobbing and fully mechanised plants. Training of unskilled male and female labour all depts. A.F.S., A.M.I.B.F. Box FS340, FOUNDRY TRADE JOURNAL.

FOUNDRY WORKS MANAGER desires position with progressive firm. Home or abroad. Ability to build or modernise existing foundry in iron, steel and non-ferrous, to meet modern day production. M.I.B.F. Box FW306, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN. Situation wanted in Iron or Brass Foundry. Good practical experience in heavy and light castings up to 60 tons. Knowledge of modern methods including green-sand, dry-sand and loam. Box FF325, FOUNDRY TRADE JOURNAL.

FOUNDRY WORKS MANAGER seeks position with progressive company where experience of layout and operation of mechanised plants and the production of high duty I.C. engine castings up to 15 tons can be used to fullest advantage. Box FW315, FOUNDRY TRADE JOURNAL.

A YOUNG FOUNDRY MANAGER, 35, seeks position as Manager or Assistant, preferably in Scotland. City and Guilds Certificate in Foundry Practice. Practically and technically trained, experienced jobbing or machine work for castings in high duty or grey iron up to 15 tons. Box AY327, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN/MANAGER, 48, M.I.B.F., desires position immediately, small/medium Foundry, ferrous, non-ferrous, West Midlands. (Country, Wales considered.) Life experience trade, full practical, technical, accept responsibility, get results, active, energetic, reliable, prospects permanency main consideration, thorough knowledge modern processes, control, jobbing, repetition. Box FM326, FOUNDRY TRADE JOURNAL.

SITUATIONS WANTED—*contd.*

FOUNDRY FOREMAN (36), A.M.I.B.F., requires similar position with progressive firm. Used to full control of Foundry and Fettling shop. Experienced in green and dry sand, and CO$_2$, also S.G., high duty, and grey iron castings up to two tons. Able to read drawings and estimate production costs. Help with housing appreciated. Box FF318, FOUNDRY TRADE JOURNAL.

A. G. WIGGINS (latterly representing F. H. Lloyd Group of iron and steel foundries in London and Southern Counties) now seeks representations within this area for quality castings, especially steels, S.G. and high-duty irons also similar. Fullest representation guaranteed. 1,500 known consumer contacts recorded. Enquiries to 61, Osidge Lane, London, N.14.

SITUATIONS VACANT

LABORATORY ASSISTANT required in a works laboratory in South West London, Surrey district. It would consist chiefly of analysis of non-ferrous alloys, some knowledge of metallography an advantage, but not essential. A progressive pensionable opportunity for a keen young man. Reply in writing, giving personal details, experience and salary desired to Box LA334, FOUNDRY TRADE JOURNAL.

PRACTICAL FOUNDRY MANAGER required for Grey Iron Foundry, Rochdale Area. Output 25 tons weekly. New post. Firm wish to improve quality and increase output. State age and experience to Box PF339, FOUNDRY TRADE JOURNAL.

AN OPPORTUNITY occurs for young man to join an established Engineers' Office as REPRESENTATIVE for Castings, Forgings and Fabrications. There are exceptional prospects for the right man. Essential qualifications are good personality, education and engineering background. Some connection an advantage. Write, giving fullest details: Box AO341, FOUNDRY TRADE JOURNAL.

A TECHNICAL SALES REPRESENTATIVE required by Baker Perkins Ltd., Bedewell Works, Hebburn, for promoting the sales of highly mechanised foundry plant and equipment. Applications are invited from suitably qualified young men possessing drive and initiative, age between 28 and 35. This is an interesting position in an expanding organisation and carries a salary commensurate with experience and qualifications. Apply in writing to the PERSONNEL MANAGER or Telephone Jarrow 89-7124 to make a convenient date for interview.

SITUATIONS VACANT—*contd.*

FOUNDRY MANAGER required to take charge of Machine Moulding, Chill Casting, Centrifugal Core Shops, in medium sized Non-ferrous Foundry in South Midlands (30 miles London). Must be good disciplinarian and have had extensive experience in above operations. Good salary and prospects offered to right applicant. Reply giving details of experience in chronological order to Box FM338, FOUNDRY TRADE JOURNAL.

AN interesting vacancy occurs in an Engineering Company in the Home Counties for a METALLURGICAL ASSISTANT. The applicant should possess initiative and have a knowledge of iron and steel metallurgy, including metallographical experience. Also a knowledge of Foundry Control would be an advantage. The work is varied and interesting, and the Laboratory modern and well-equipped. Please reply, giving details of age, salary required and experience to Box AV332, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2.

METALLURGIST or FOUNDRY TECHNICIAN required to take over technical control in light alloy foundry. Applicant must have had practical foundry experience in the manufacture of high strength aluminium alloy castings to aircraft standards.

The post is permanent and offers good prospects in a steadily expanding business. Applications stating age, experience and salary required to: MANAGING DIRECTOR, Brytallium Castings (Bolton), Ltd., Prospect Foundry, Smithills, Bolton, Lancs.

AN experienced METALLURGICAL CHEMIST is required for routine assays of non-ferrous alloys (including white metals). The laboratory is well equipped and well staffed, and is located in the South Western district of Greater London. The position carries a good salary, a pension and is progressive to considerable responsibility with corresponding remuneration. Write giving personal details, experience and present salary to Box AE333, FOUNDRY TRADE JOURNAL.

STEWARTS AND LLOYDS, LIMITED STEEL FOUNDRY REPRESENTATIVE

APPLICATIONS are invited for a vacancy as a REPRESENTATIVE covering area Birmingham and Southern England, for the Steel Foundry of the above Firm. Essentials are a sound knowledge of steel foundry practice and experience in this type of representation. The successful applicant would be required to live in the Birmingham area. Letters should be sent addressed to THE MANAGER, Personnel Services, Clyde Tube Works, Coatbridge, Lanarkshire, Scotland.